ELECTRICAL REVIEW

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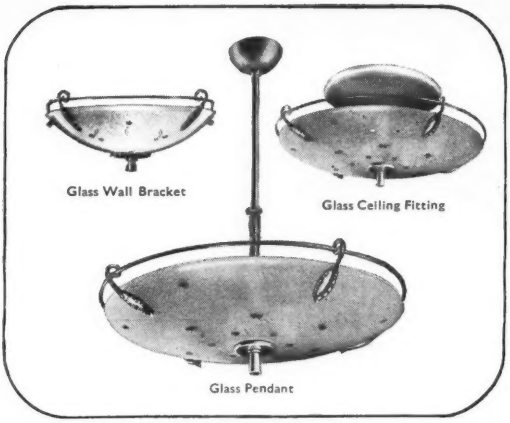

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ELECTRICAL REVIEW

Vol. CXLIX No. 3866 28TH DECEMBER, 1951

THE OLDEST ELECTRICAL PAPER ● ESTABLISHED 1872

Healthy Rivalry

ELECTRICITY AND GAS ACTIVITIES

IN spite of continued talk of fuel co-ordination, the electricity supply and gas industries are still competitors and it is as well that they should be. The two monopolies are by this means kept on the alert and the public is protected against absolute monopoly. It is profitable for each of them, therefore, to keep an eye on what the other is doing.

Competition between them is particularly pronounced in the domestic business, a most important section for both. The domestic consumers of gas take over half of the total production; in the electricity industry the figure is about a third. In both cases the potential demand is growing but is being held in check for similar reasons. Yet in both cases the public is being kept aware of the virtues of electricity and gas.

Informing the Public

On behalf of the electricity supply industry the Electricity Boards, assisted by the British Electrical Development Association, are discreetly keeping electrical appliances before the public while discountenancing excessive use during peak periods. The gas industry, as is recorded in the Gas Council's second annual report, is aware of the importance of impressing the advantages of gas upon women and is continuing to support the Women's Gas Federation, which is the counterpart of the Electrical Association for Women but not, we should say, so active. There has been an increase in the number of gas " home service advisers " whose job is ostensibly to assist housewives to use their appliances efficiently and economically.

Use of Films

The gas industry, as does the electricity industry, sets out to " catch them young " by using films, film strips, wall charts, etc., designed for children. In this direction, E.D.A.'s educational films are much more potent, although the gas people have managed to have a cartoon film adopted by the major cinema circuits for their children's programmes.

Within the limits imposed by supply conditions the gas cooker business is being cultivated, particular emphasis being laid upon the replacement of old cookers. The North Thames Gas Board, for instance, replaced 60,000 " black " cookers by vitreous enamelled ones during 1950–51.

It is something of an admission of past inefficiency that, according to the report, " a modern cooker will give the same service as an old-fashioned one and

save up to 40 per cent of the gas used." Gas water heaters, it is said, will satisfy a very real need " with proper maintenance." This is where electric water heaters score heavily. Maintenance is negligible and there is no gas equivalent of the immersion heater. The report complains about the purchase tax on gas appliances—a disability which the electricity industry suffers from even more.

Supplies to new housing estates are being provided for but delayed deliveries of cast-iron pipes have created difficulties. The importance of " freedom of choice " for tenants is emphasized, but so is the importance of a remunerative return. Here is a problem which bears severely on both services but probably harder on the electricity supply industry which is too often expected to provide services for lighting and other small uses only.

Concluding as we started, we do not think that these manifestations of competition between the two industries are harmful. We deprecate any attempt by " authority " to prescribe which service the public shall use for particular purposes and thus stifle enterprise and progress.

THE CONVENTION

Since our notes on the future of the British Electrical Power Convention appeared last week, we have learned that curtailment of the period has been definitely decided upon. It will now open on the morning of Monday, 16th June, and conclude at mid-day, Wednesday, 18th June. The programme, as already agreed, will be undertaken in full. In the circumstances it has been decided that the customary electrical exhibition will not be held. We must accept this decision but still express our disappointment and re-state our belief that it is not in the best interests of the electrical industry.

POWER FOR TEXTILES

Some difficulty has been experienced in arranging load spreading in the textile industry, not because it is considered unnecessary but on account of the operatives' reluctance to work unusual hours. However that may be, the *Manchester Guardian* says that the British textile industry has been more fortunate in the matter of power than its principal competitors. It repeats what we have already reported that the Bombay Government has decreed a one-third cut in consumption of electricity. In Japan many mills are idle for two days a week through lack of power. It is to be hoped that such unfavourable conditions will not be experienced here; the safeguard lies largely in the hands of the textile industry itself.

" VINTAGE YEARS "

Is the hope expressed in the last paragraph of the reminiscences presented under the above title on another page likely to be fulfilled? The query is not whether it is too late for pioneering engineers to record their memoirs, but whether it is practicable to finance the compilation of such recollections into a comprehensive history of the great electrical industry of this country, which has in many respects led the way in almost all parts of the world. There can be few men still living who would consider it worth while to undertake the task — a formidable one, even if they were so inclined and were intimately knowledgeable of so many-sided an industry.

LIMITED DIVIDENDS

After discussions with the Chancellor of the Exchequer and the Minister of State for Economic Affairs the president of the Federation of British Industries (Sir Archibald Forbes) has circulated a letter to chairmen of member companies on the subject of dividend limitation. He says that the Chancellor looks upon restraint in the distribution of profits as a means of controlling inflation, not so much of itself but because increased distribution is likely to stimulate demands for additional salaries and wages. The letter has had a mixed reception. Many feel that too much restraint has been expected from shareholders at a time when everybody else's remuneration has gone up. On the other hand, the conservation of profits is becoming more essential as the raising of new money for normal development is becoming more difficult.

GOOD WISHES

We thank the many readers who have sent us seasonable greetings and express once again the hope that the New Year will be a prosperous one for them and the whole of the electrical industry.

AIRCRAFT ELECTRICS

Power Supply System of the Saunders-Roe "Princess"

THE first of the three Saunders-Roe SR/45 "Princess" long-range flying boats, which are under construction at Cowes, Isle of Wight, is nearing completion and it is expected to make its maiden flight in the late spring of 1952. This high wing ten-engined machine with single fin and rudder has a gross weight of about 140 tons. Its wing span is 225ft, its length 148ft, height 55ft 9in and beam 16ft 8in. It is designed to operate at an altitude of 40,000ft with a range of 5,500 miles in still air at a cruising speed of 380 m.p.h.; pressurizing maintains 8,000ft conditions up to operating altitude. The original interior layout, which provided luxurious accommodation for about 100 passengers, with sleeping berths, cocktail bars and so on, has been abandoned and now all three aircraft are to be used by the R.A.F. as troop transporters.

The ten 3,500 h.p. Bristol "Proteus" propeller turbine engines are arranged in four coupled pairs and two single outboard units, the coupled pairs being geared to single contra-rotating propellers. The outer engines are normal single installations each driving a single propeller; all accessory drives for generators, cabin blowers, etc., are taken from the coupled units.

In an aircraft of this size the electrical power requirements are obviously great, some 168 kW in fact, and to meet this demand six generators, driven through gearing from the four coupled pairs of engines, have been installed. The main power supply is a nominal 120 V d.c. system with earth return, supplied by four 39 kW generators, with a 63 Ah 108 V battery also connected, each generator being associated with one of the coupled pairs of engines. Both outboard coupled pairs of engines also drive a 6 kW 24 V d.c. generator supplying power for general control purposes throughout the aircraft. This includes the radio station, switchgear operation, engine control, etc. As the arrangement of the 24 V system is similar to that of the main 120 V power supply, but on a smaller scale, this article is confined to the latter (Fig. 1, p. 1296).

The generators are paralleled in pairs to port and starboard busbars which each supply port and starboard distribution busbars to which the main services of the aircraft are connected. Complete paralleling of generators is therefore achieved through the distribution cables which incorporate out-of-balance current protection and fault current limiting resistors. The battery busbar, to which a few loads are directly connected, is similarly paralleled between the port and starboard distribution busbars.

The voltage at the generator busbars is maintained at 126 V $\pm$ 2·5 per cent by individual carbon pile regulators controlling the field current of each generator and a load sharing circuit between all four generators is provided; over-voltage protection for each generator is also provided.

The system is designed for fully automatic operation, the generators being brought on to the busbar when their speed rises above the minimum operating speed and disconnected when it falls below this speed. The automatic features are achieved by the use of a differential cut-out unit

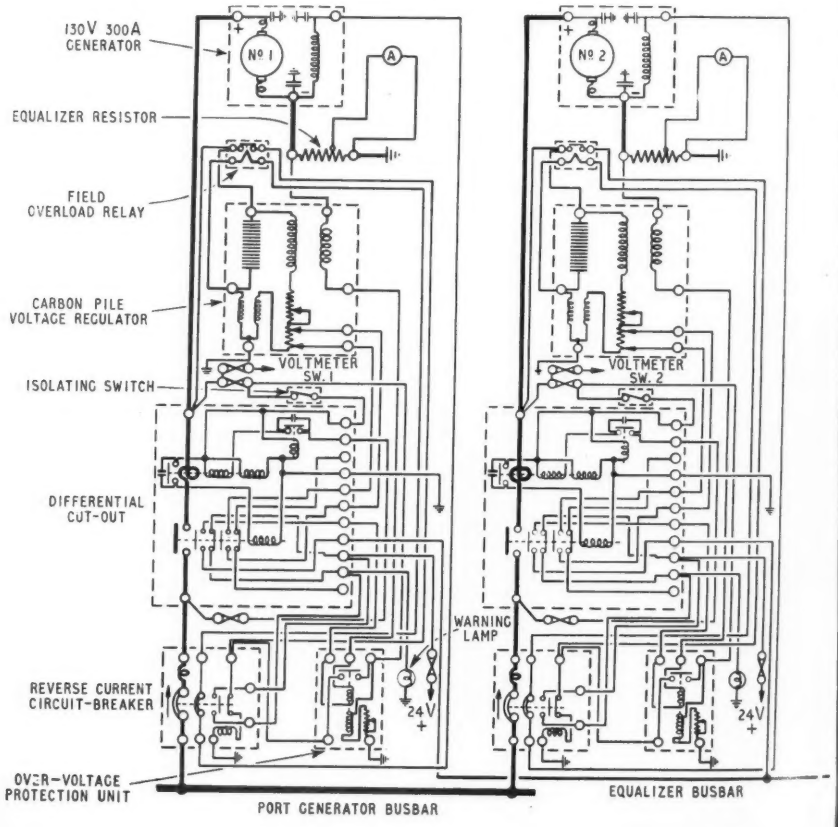
connected between each generator and the busbar; this unit also includes protection against a possible reversed polarity generator connection.

No forward protection is provided at the generation system, but each generator circuit is protected against fault conditions by a reverse current breaker situated at the busbar which operates in both the main and field circuits. These breakers incorporate a manual trip which may be used to isolate a generator circuit in an emergency.

From the main generator connections (Fig. 2, p. 1298) the main positive feed to the busbar can be interrupted at two points: the contactor of the differential cut-out unit, which is the normal method of connecting and disconnecting the generator, and the reverse current circuit breaker. The shunt field circuit of the generator is connected from the positive line through the carbon pile of the regulator and the bimetal of the field overload switch to the field breaker contacts of the reverse current circuit breaker to the field winding. The field negative is commoned with the armature negative within the generator and the circuit is connected to earth through the equalizer circuit resistor, part of which is tapped and used as an ammeter shunt. Radio interference suppression capacitors are provided in the generator terminal box.

The field overload switch is connected on the negative side of the carbon pile so that

Fig. 1.—Circuit diagram of the 120 V d.c. generating

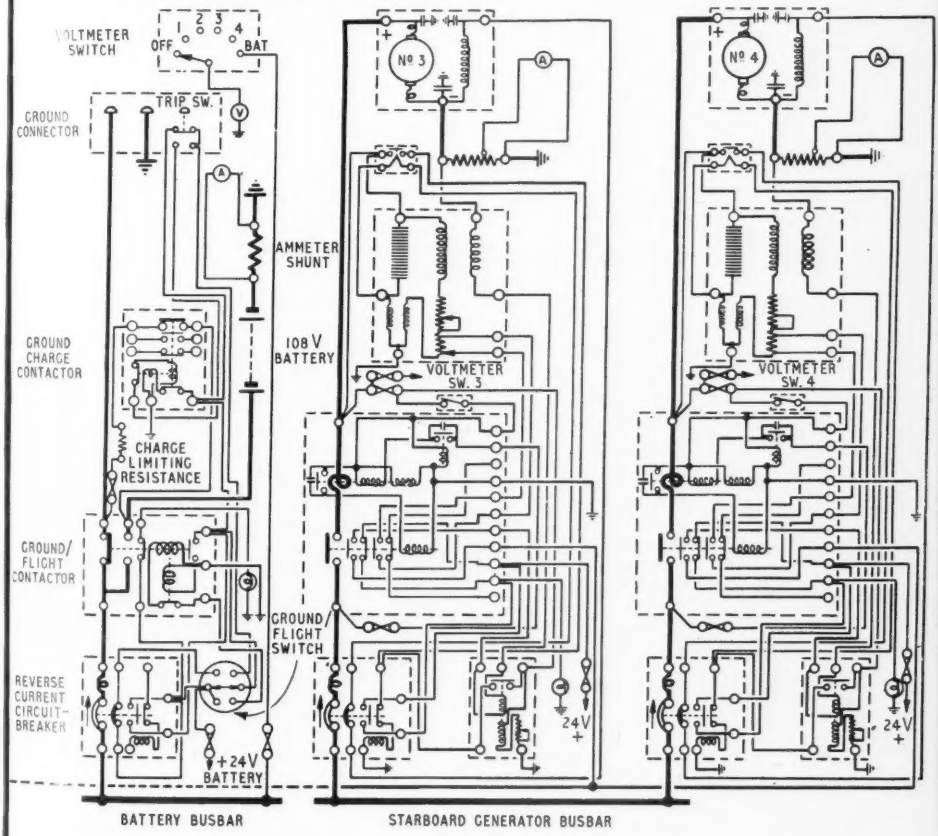


n the event of a fault to earth the pile itself imits the current to a value which will not damage the bimetal of the switch. Operation of the switch by high current in the field circuit closes a 120 V circuit to the remote trip coil of the reverse current breaker which operates and de-energizes the generator by isolating both the armature and field circuits.

The reverse current circuit breaker is manually closed and mechanically latched in this position; it is normally left closed. The main electrical operating mechanism is polarized so that only a current flowing back into the generator from the busbar will cause it to function. A minimum reverse current of 300 A through the series coil is required to operate the mechanism and a time delay unit is incorporated to prevent "nuisance" tripping under surge conditions. This gives a time delay of about 0·07 sec at minimum operating current, but under high fault current conditions the operation of the circuit breaker is extremely fast (of the order of 15 milliseconds total time).

The main control coil of the carbon pile voltage regulator is connected directly across the positive feed to earth with a conventional ballast resistance and trimmer resistance in series to provide adjustment of the regulated voltage level. A stabilizing transformer is included in the regulator, having one winding in series with the main

ystem in the Saunders-Roe "Princess" flying boat

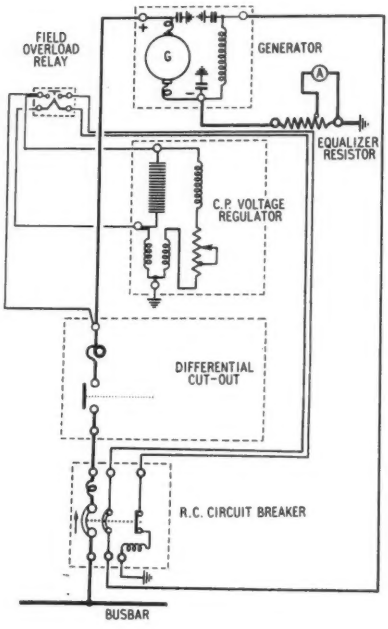


coil and the second winding shunted across the field circuit to earth. Any transient surge or voltage change either in the field or control coil circuits will induce voltages in the transformer windings which will tend to damp out the changes, thus preventing hunting and limiting surge conditions.

Generator isolating switches fitted with guards are included in the positive supply to the differential cut-out, but these are only intended to isolate a generator before engine running during ground testing and are not for flight use.

The differential cut-out (see Fig. 3) consists of a polarized voltage pick-up relay (VR), differential relay (DR) and main contactor (MC). The drawing shows the unit under conditions of generator at rest. As the generator is run up, the voltage is applied to the coil of VR, which is polarized so that in the event of a reversed polarity the relay will not close. This also greatly reduces the voltage range over which the differential coil of DR has to operate with the result that the latter relay can be made more sensitive.

Fig. 2.—Main 120 V d.c. generator connections



The differential relay is also polarized and has three windings: (1) a voltage, or shunt coil which would operate the relay unaided at 154 V, (2) a differential voltage coil connected between generator and busbar which is only in circuit when VR closes and (3) a heavy current single-turn series coil.

At a predetermined generator voltage (about 100 V) in the correct sense, VR closes and connects the differential coil of DR between the generator and busbar. So long as the generator voltage is less than that at the busbar the ampere-turns of the differential coil oppose those of the voltage coil and the magnet holds the relay open. As the generator volts rise above the busbar volts, the current reverses in the differential coil and when it is 2 V to 3 V above the busbar the combined effect of the two coils overcomes the magnet and DR closes. In this manner the generator is prevented from going on to the line until it is capable of supplying power.

When DR closes, the operating coil of MC is energized, its contacts completing the circuit from generator to busbar. The flow of forward current through the series coil of DR assists in holding this polarized relay closed although the differential coil is shorted out. One pair of auxiliary contacts on MC controls a 24 V supply to a warning lamp which is lit while the generator is disconnected from the busbar. Tripping of the reverse current breaker for any reason will also light this warning lamp.

If the generator speed is reduced below the minimum at which it can provide power, current will flow in the reverse direction in the main circuit. This causes the ampere-turns in the series coil of DR to reverse and oppose those of the voltage coil and DR opens, dropping out MC and disconnecting the generator. A reverse current of from 35 A to 40 A is sufficient to release DR. The polarized voltage pick-up relay VR is designed to drop out at not lower than 60 V.

The tripping times and currents of the differential cut-out and of the reverse current circuit breaker are co-ordinated so that the cut-out deals with all normal circuit switching, but under fault conditions the breaker operates faster than the differential unit. The contacts of relays VR and DR are bridged by arc suppression capacitors.

Load sharing between generators is achieved by an equalizer circuit (see Fig. 4) in which each generator negative line is connected to earth through a calibrated resistance arranged to give a 0·5 V drop across its terminals when carrying the full load current of 300 A. These resistances are mounted together at a common earthing point, approximately on the centre line of the aircraft at the front spar. The four generator negative ends of the equalizer resistors are connected together through coils on the relevant voltage regulators and an equalizer busbar.

If the generators are not carrying equal loads, there will be differences in potential at the equalizer resistors and currents will flow through the equalizer coils on the regulators which are connected so as to increase the voltage of a generator taking less than its share of the load and to reduce the voltage of generators carrying more than their share.

Clearly, if one generator is switched off, it will have no potential at its equalizer resistance and the equalizer circuit will operate so as to reduce the voltage of the generators left on the line. To prevent this, the circuit to the equalizer busbar is completed through a pair of normally open contacts on the main contactor of the differential cut-out unit. Thus the equalizer circuit is completed only when the generator concerned is connected to the main busbar.

After the first generator has been connected to the busbar, a second incoming generator would be regulated so that its voltage would not be able to rise sufficiently above the busbar to operate the differential relay. To overcome this difficulty an additional resistance is included in the carbon pile regulator, in series with the main coil, set in order to increase the regulated voltage level of the generator by between 7 and 10 per cent. When the differential cut-out main contactor closes, this resistance is shorted out by auxiliary contacts on the contactor. Thus all four generators will come on to the busbar

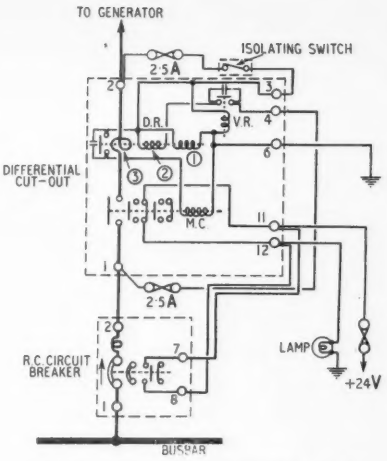
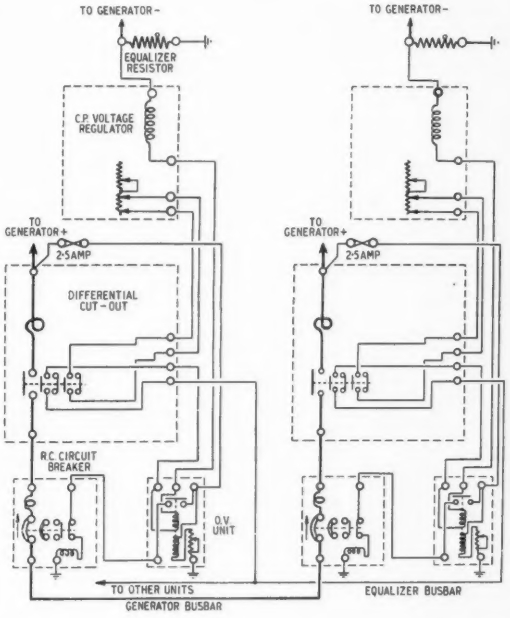


Fig. 3.—Main generator differential cut-out

Fig. 4.—Equalizer circuits for load sharing between the generators also incorporating over-voltage protection



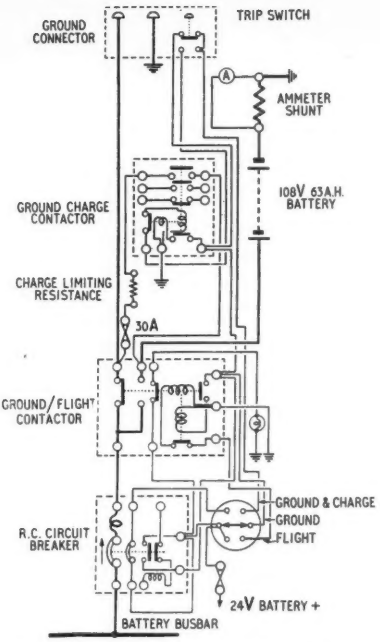


Fig. 5.—General arrangement of battery system

even under conditions of very light load. The generators and system are protected against over-voltage under all conditions by means of polarized relays very similar to the differential relays in the cut-out units but omitting the heavy current series turn. The voltage coil is connected between the generator positive, via the fuse, and earth with a trimmed resistance in series. This coil unaided would overcome the magnet and operate the relay if the voltage rose as high as 144 V.

The voltage coil is compounded by a current coil connected to the generator negative end of the equalizer resistance and through contacts in the differential cut-out and a common equalizer busbar to the other units. The potentials operating in the latter coils are at all times the same as in the regulator equalizing circuit and the two coils are in fact connected in series and use a common equalizing busbar.

Should the voltage of any one generator rise beyond the control of the normal regulator coil and equalizer circuit, there will be currents flowing in the current coils of the polarized over-voltage relays such as to add to the ampere-turns of the voltage coil of the unit connected to the generator giving excess voltage and in opposition on all other relays. Thus the fullest discrimination is obtained; the on-load tripping voltage and current unbalance is of course a function of the number of generators operating on the line, but the extent of compounding is such that with two generators in parallel, the appropriate relay will close at 132 V with a current unbalance of $\pm$ 50 A.

Operation of the over-voltage unit completes a 120 V circuit to the remote trip coil of the reverse current circuit breaker, operation of which isolates and de-energizes the faulty generator circuit. If the generator is disconnected or isolated from the busbar, over-voltage protection is still afforded since the voltage coil is always in circuit.

The battery system (Fig. 5) is protected against a possible battery, circuit or ground supply fault by connection to the battery busbar through a reverse current circuit breaker identical to the type used in the generator lines. This circuit breaker is manually closed and left closed; normal switching is effected by a mechanically latched change-over contactor. In Fig. 5 the system is shown at rest with the ground supply connected to the busbar and the aircraft battery isolated from the system.

The operating coils of the contactor are energized directly from the 24 V battery by means of the rotary ground/flight switch. Setting of this switch to "flight" position energizes the closing coil of the ground/flight contactor which closes and latches, the operating coil being de-energized by internal auxiliary contacts. The battery is then connected to the busbar and the ground supply isolated. At the same time another auxiliary contact of the contactor closes and completes the internal circuit of the unlatching coil.

Tripping of the circuit breaker by a battery system fault automatically energizes the unlatching coil of the contactor which opens and isolates the battery. This ensures that in the event of a cable fault the battery as well as the busbar is isolated from the fault. The unlatching circuit is also completed by returning the ground/flight switch to "ground." Under all conditions of battery isolation a warning lamp is lit, the circuit being completed through auxiliary contacts on the contactor.

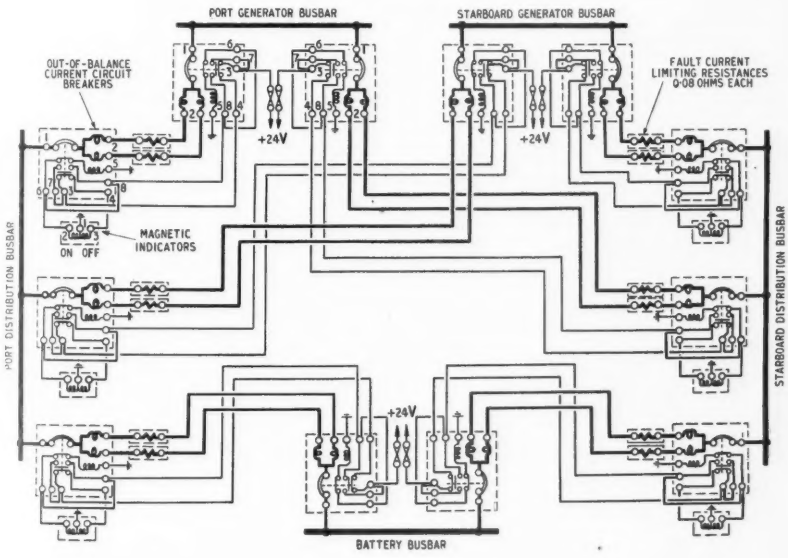
The cable unit of the ground supply connector carries an auxiliary switch, actuated by the compressed main contacts, controlling the ground switchgear which ensures that the ground supply is always isolated before the contacts part from the aircraft member. Provision is also made for charging the battery from the ground supply without removing it from the aircraft. A small mechanically latched single-pole contactor, when closed, completes a circuit bridging the ground supply positive to the battery. This ground charge contactor is controlled by a third position of the ground/flight switch known as "ground and charge" which completes the circuit to the closing coil of the contactor. A miniature change-over switch in the aircraft member of the ground connector ensures that the circuit cannot be closed unless the cable unit is attached to the aircraft and locked. It also unlatches the contactor and isolates the circuit if the cable unit is detached, the circuit normally being isolated by returning the ground/flight switch to "ground."

A charge-limiting resistor and h.r.c. fuse are included in the circuit, and an ammeter on the earth side of the battery indicates the rate of charge or discharge of the battery under all conditions.

The power distribution system (Fig. 6) is based on the ring main principle. The port generator busbar is connected to both the port and starboard distribution busbars, the starboard generator busbar being similarly connected. The battery busbar is connected to both distribution busbars and through them to the two generator busbars. Each connecting feeder consists of identical twin cables cut from the same coil and connected to the busbar at each end by an out-of-balance current high speed circuit breaker. These circuit breakers are manually closed and mechanically latched and are normally left closed, but they incorporate means for manual tripping. They are intended to protect the system against a possible cable fault between busbars, but must not operate under any other conditions, irrespective of the magnitude or direction of the current.

A 0·08 ohm resistor is connected in series with each cable between the circuit breakers to limit the fault current which can reach any circuit breaker in the system, with the configuration of feeders as mentioned, to their rated rupturing capacity of 8,000 A.

Fig. 6.—Complete 120 V d.c. power distribution system



Without such artificial impedance and this variation of the ring main circuit the instantaneous short-circuit current produced by the generators, battery and the regenerative capacity of rotating machines could reach a figure of 17,000 A.

To follow the circuit details, it is perhaps best to consider the feeder connecting the port generator busbar to the port distribution busbar; all other feeder circuits are identical. Current from the generator busbar flows in at terminal 1 of the out-of-balance current circuit breaker and out at terminals 2, dividing equally between the two paths through two identical fault current resistors; it joins again in a single path in the second circuit breaker to reach the port distribution busbar. Each circuit breaker has two identical heavy current coils, between the breaker contacts and the pair of terminals 2, wound in opposition so that with the current dividing equally between the two paths no resultant forces are produced, irrespective of the magnitude or direction of the current flowing.

If a fault of any description occurs in one of the cables, e.g., a fault to earth or an open circuit, the currents flowing in the two coils of one or both of the circuit breakers are no longer equal. The resultant ampere-turns from the unbalance operate a tripping mechanism which unlatches the circuit breaker and disconnects the feeder from the busbar. A current out-of-balance of 90 A, irrespective of the total current flowing, its direction or the sense of the unbalance is sufficient to trip the breaker.

An auxiliary 24 V circuit controlled by contacts on each circuit breaker ensures that both breakers operate together, and completely isolate the defective feeder, by energizing the remote trip coil of the other unit. In the unlatched open position of the circuit breaker, this coil is de-energized by other internal auxiliary contacts. Magnetic indication of the open or closed position of the pairs of breakers is included in the circuit.

All main electrical services are connected to the port and starboard distribution busbars and the loads on the two sides are identical. A few stand-by or water-borne loads are, however, connected to the battery busbar direct. All supplies are taken from the busbars through thermal overload and magnetic circuit breakers, which have the full fault current rupturing capacity of 8,000 A irrespective of normal load rating. These circuit breakers are manually closed and latched and are intended to be left closed, normal circuit switching being carried out on associated contactors. A conventional bimetal is incorporated to give the thermal overload tripping characteristic, but a magnetic trip unit is also included to operate instantaneously in the event of high fault currents flowing.

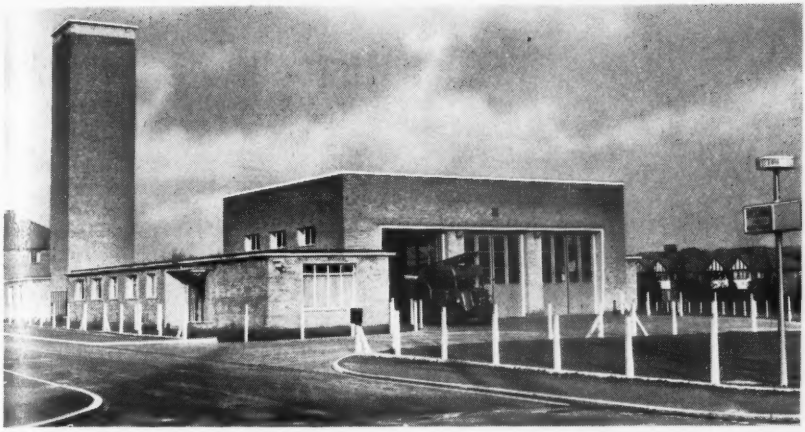
The fault current limiting resistors in the distribution system introduce a regulation voltage drop, but under normal conditions this does not exceed 50 A/V to the distribution busbars and 6·5 V drop to the battery busbar under aircraft steady full load conditions.

All busbars and their associated incoming and outgoing circuit breakers are mounted in locked busbar boxes. As a second stage insulation protection these boxes are insulated from earth, but to limit radio interference they are tied to earth potential by an h.r.c. fuse shorted by a warning lamp. In the unlikely event of a first stage insulation failure, the fuse is blown and the lamp lights to give warning of the failure, but the operation of the system is not jeopardized.

The complete electrical installation employs about 56 miles of cable, but in the first of the three aircraft the figure is more like 70 miles owing to additional instrumentation; crimped solderless connections are used throughout.

The loads on the port and starboard 120 V d.c. distribution busbars are identical and comprise mixed tungsten and fluorescent lighting, engine starting and propeller de-icing, flying controls, float retraction and flaps, propeller feathering and bilge pumps, galley loads and ventilating fans. There are also two motor-alternator sets, one supplying three-phase 400 c/s 115 V to the fuel pumps and the other, a three-unit set, three-phase 400 c/s and single-phase 1,600 c/s 115 V to the radar and instrumentation systems. Though the fluorescent lighting is d.c. operated, no polarity reversal arrangement is necessary owing to improved lamp manufacturing methods.

Acknowledgment is due to Saunders-Roe, Ltd., for the photograph of the model of the " Princess " and diagrams, and to Mr. A. Ball, electrical engineer, Mr. A. E. Swain, assistant designer, and Mr. R. J. Wraith of the electrical design office for their assistance in the preparation of this article. The consulting engineers for the aircraft electrical system were the British Thomson-Houston Co., Ltd.



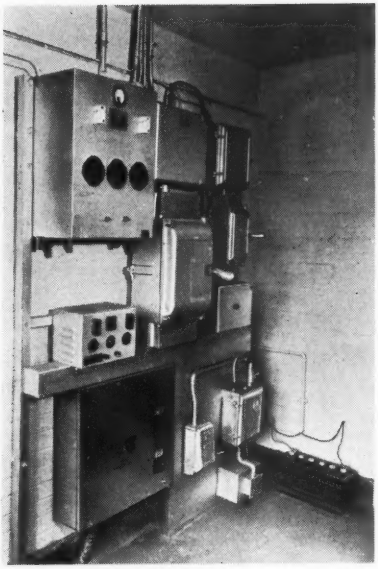
New Fire Station

Up-to-Date Electrical Devices Employed at Derby

ALTHOUGH a combined police and fire station was opened some time ago in the Isle of Wight, a new fire station just inaugurated in Nottingham Road, Derby, is, we understand, the first building designed exclusively as a fire station opened since the war. From the electrical point of view the installation is therefore of particular interest, especially since the opportunity has been taken to incorporate all the latest electrical devices calculated to increase the efficiency of the fire service and also improve working conditions.

The station is equipped with four appliances, a pump escape, a major pump, a foam tender and a hose carrier. Spring rubber cables, connected to points in the roof, are plugged into the dashboards of these vehicles both for battery charging and also for engine preheating by means of Bray heating elements (450 W) which are

Above: **The new fire station in Nottingham Road, Derby, showing the illuminated direction and warning sign.** *Right:* **The appliance room showing leads for engine heaters and battery chargers, and top left an illuminated sign indicating which appliances are required**



Main switchboard, incorporating vehicle battery charger and rectifier for the alarm system

permanently attached to the radiator system.

Adjoining the appliance room is the control room in which are an illuminated map of the area, the telephone switchboard and a compact control board (Britmac) which covers all the warning bells, signs and lights. Apart from a siren on the appliance room roof there are " Tangent " fire bells at various points in the building. An illuminated indicator board suspended from the roof of the appliance room shows which appliances are required, while a sign outside the station, besides incorporating a panel permanently illuminated at night to denote that the building is a fire station also has a flashing sign warning the public and traffic to beware of approaching appliances. The fire bell outside the building and also the inquiry signs are illuminated by tubular lamps. The alarm system is arranged so that in daytime only the bells are in operation.

Special attention has been paid to the lighting of the working areas. Floodlights (B.T.H.) have been provided in the forecourt and in the yard at the back. In the latter case the fitting is mounted on the side of the drill tower, which, used also for hose drying, is illuminated inside as well as on each floor by means of bulkhead fittings. Additional lighting in the yard comes from bulkhead fittings on the walls of the surrounding buildings, which comprise the canteen, hose store and workshops, and various offices.

Inside the building Thorn reflectors with " Atlas " quick-start fluorescent tubes are employed in the appliance, control and locker rooms and 10in " Coolicon " plastic lighting fittings have been installed in the canteen, dormitory and offices. One of the three lights in the duty officer's room is

Left: **Tubular heaters are used to dry wet clothing.** *Right:* **Compact control board and telephone switchboard in the control room**

permanently connected to the night switch. For convenience and low capital cost electric heating has been adopted throughout the building with the exception of the canteen. As a safety precaution most of the fires, which are of the wall panel or adjustable reflector types, are mounted high on the walls. In the room where wet clothing is dried banks of thermostatically controlled tubular heaters (Unity) have been installed. The canteen is equipped with a Jackson cooker and a television set.

The electrical installation has been carried out in Pyrotenax mineral insulated cable, laid in ducts in the floor or in screwed galvanized conduits. All the switches and control gear are housed in a separate switch room with a switchboard comprising a Bill 200 A main switch, distribution board and switch-fuses, Heayberd battery charging equipment and rectifier for the alarm system, and a Londex relay which switches on the various bells, signs, lights, etc., on the operation of the main fire alarm switch.

The installation was carried out by the East Midlands Electricity Board, which designed the layout in consultation with the Architectural Department of the Derby Corporation. We are indebted to Mr. H. A. C. Smith, chief fire officer, Derby, for his help in preparing this article.

Development in the West Indies

Report of Trinidad Commission

THE major activity of the Trinidad and Tobago Electricity Commission in 1950—the year covered by the latest report—was in connection with the southern power scheme. Boiler plant and turbines for the Penal power station started to arrive during the year and good progress was made with the construction works. A 66 kV transmission line from Port-of-Spain and a 33 kV line along the Churchill-Roosevelt highway were energized and a 12 kV distribution line at Couva was made alive under test. Altogether 65 miles of new overhead lines were erected and 57 additional transformers provided.

The Commission and the Port-of-Spain Corporation Electricity Board were constituted in 1946, taking the place of the Trinidad Electricity Board which had operated the undertaking pending the decision of the Governor to embark upon an island-wide scheme. The report records that following the division the final settlement of the accounts was made last year.

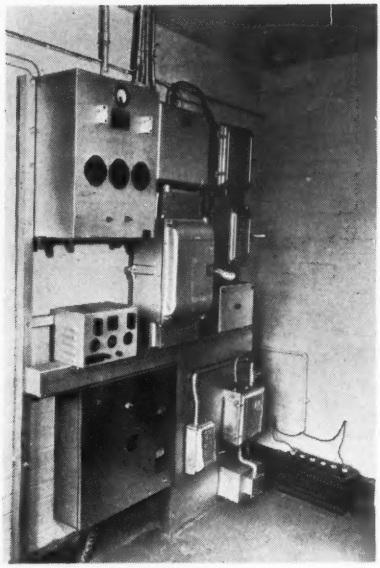
The Commission is responsible for generation in the north of the island and undertakes distribution outside the Port-of-Spain area. A bulk supply is provided to the Port-of-Spain Board which, besides distributing electricity, also operates the transportation system and the house wiring and retailing departments formerly carried on by the Trinidad Electricity Board. There is a third undertaking in the island, that of the San Fernando Borough Council, which controls both generation and distribution in the municipal area.

In 1950 the Commission supplied 17·3 million kWh directly to 12,718 consumers (excluding street lighting). It also provided a bulk supply of 24·1 million kWh to Port-of-Spain. New consumers connected numbered 1,505, but owing to the continued shortage of generating plant the Commission could not accept any further large users. Even so, the maximum demand of 10,400 kW was four times as much as in 1940. Of the retail sales, 8 million kWh, or nearly half the total, went to 144 industrial power consumers and 5·1 million kWh was supplied to 2,969 consumers under the domestic light and power tariff. Most of the consumers (over 9,000) were however served at the standard lighting rate and their average consumption was only 184 kWh. The report mentions that equipment for radio-telephone communication was received during the year and proved of great assistance in the operation of the distribution department. The result of the year's working was a surplus of $98,522 compared with $104,391 in 1949.

Since the close of the year under review, Mr. J. H. Reid, B.Sc., has retired from the position of general manager of the Commission and has been succeeded by Mr. K. W. Finch, B.Sc., A.M.I.E.E.

Electric Railways for the Midlands?

PLANS for a conference of Black Country civic leaders on ways of speeding up the region's transport system are being considered by the Mayor of Walsall, Alderman Tom E. Mayo. One of the proposals the conference would study would be the electrification of the railway network serving the area.



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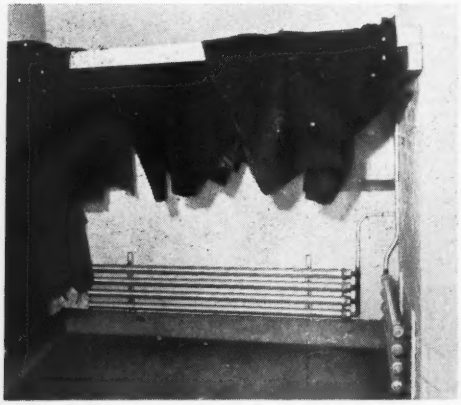

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Pumped Storage

American Hydro-Electric Comparison

TOTAL world capacity of pumped storage plants is now over 1,500,000 h.p. and 825,000 h.p. in associated pumps, according to Mr. C. H. Spink of the Federal Power Commission, U.S.A.

In an article in *Power Engineering* he refers to four fundamental types. In the first a generator-motor, turbine and pump are in tandem on one vertical shaft. The second is a horizontal duplex unit having a generator-motor with a turbine on one end of the same shaft and a pump on the other. The third embodies a conventional hydro electric unit and a separate motor driven pump. The fourth type, which is regarded as most likely to secure favour in the United States (where only three plants are installed at present) comprises a vertical Francis single-runner single-speed reversible pump-turbine with generator-motor. Tests have indicated a best efficiency for the turbine of 87 per cent at 9,450 h.p., 87ft head and 163·6 r.p.m. and for the pump 88 per cent at 1,150 cu ft/sec, 63ft head and 163·6 r.p.m.

Application to Conditions in 1970

Comparison has been made between conventional hydro-electric and pumped storage schemes for a large interconnected hydro and steam system in conditions expected in 1970. The total water discharge is 16,000 cu ft/sec daily at certain load factors. The total dependable capacity in four reversible units is 43 MW and in two conventional units 41 MW, a total of 84 MW. The dependable hydro-electric capacity of 443 MW for all plants on the system was placed on the peak of the August, 1970, load curve, leaving 1,297 MW to be supplied by existing and new fuel stations. Pumping capacity of 325 MW required at the various projects (345 MW including transmission losses) would use a total of 108 million kWh in the month.

For the five dams assumed to be constructed, the total capital cost with pumped storage would be, it is estimated, $80 million, and the annual costs, including off-peak energy at 1·5 mills/kWh, would be $8 million. The value of dependable capacity was reckoned at $24·7/kW and of energy at load centres 1·05 mills, giving a total benefit of nearly $9 million, the economic ratio of benefits to cost thus being 1·069 to 1·0, or slightly better than equivalent steam at the load centre.

With the same five dams a normal hydro-electric scheme with a smaller installation was estimated to cost $35 million, the annual charges at 9·26 per cent being $3·3 million. The total dependable capacity would be 65 MW and 256 million kWh. The economic ratio would be 0·578 to 1·0. The cost of $600 (as sold) per kW installed compared with $227 for pumped storage. In addition there is the benefit to the steam system load factor.

Desirable Improvements

Attention is drawn to two requisite improvements in design. One is for an electrical machine that would have two satisfactory speeds, the higher being for pumping. The other improvement would be an adjustable-blade Kaplan-type runner with blades reversible for pumping without change of direction of rotation.

Shannon Scheme Operation

AT a meeting of the Irish Branch of the Institution of Electrical Engineers, which was attended also by members of other engineering institutions, Mr. P. Byrne, B.E., B.Sc., spoke on the Electricity Supply Board's generating station at Ardnacrusha (Shannon Scheme).

Mr. Byrne referred to the discovery in 1944 that as a result of a slight settlement in the foundations at Ardnacrusha all four main generating sets had taken a slight tilt from the perpendicular and he described the manner in which the defect had been rectified. Since then there had been no recurrence of the trouble. The only other incident of note was the sudden shutting down of the two small house turbines. When they were dismantled it was found that several eels had fouled the runners. The lecturer was thanked by Mr. B. O'Mongain, B.Sc.(Eng.), chairman, who presided.

VIEWS on the NEWS

By REFLECTOR

It is not surprising that omnibus drivers are reported to be complaining about the way in which fluorescent lamps are being installed in shop windows, particularly those fitted vertically at the sides of windows, which can temporarily "blind" a vehicle driver whose eyes happen to catch bare lamps in such positions. Some installations of this kind are positively amazing, but who is to set himself up as the arbiter in such cases? It will be a pity indeed if irresponsibility in installation is allowed to discredit a form of lighting which, when used correctly for the right purposes, can be both effective and good to look at.

* * *

Sparking plugs of motor-car engines certainly create enough disturbance on the television screen but a cyclotron should be able to put up a much better show. This has been the case at Birmingham where complaints of extensive and intensive interference have caused the Post Office engineers to conduct investigations. They found that the oscillator unit of the University's cyclotron was to blame. Rectification is not such an easy matter as it is in a motor-car engine but it is said that the trouble can be prevented by extra screening, a job that should not take very long.

* * *

Since 1914, reports a special correspondent of the *Observer*, a street lighting controversy has raged in the village of Beckbury, Salop (pop. 350). In that year the offer of a public-minded resident to provide a lantern with four candles was rejected. When the subject was discussed recently it was pointed out that the Parish Council had no power to institute tallow-candle lighting and in any event the permission of three authorities would be required. First, there would have to be "planning" authorization from the Salop County Council; secondly, the highway authority would have to be consulted and authority for the work under Defence Regulation 56A obtained from the Ministry of Transport; thirdly, the permission of the Midlands Electricity Board would have to be obtained for the mounting of the lantern on one of its poles. The presence of this pole suggests that electricity is available but apparently the village is against such extravagance as electric lighting—or lighting of any kind.

* * *

Many and varied are the methods adopted by people who need electricity but are unwilling to pay for it. I think, however, that a recent case is original. It was at Bath, where, according to the *People*, a man was fined £3 for "fraudulently diverting electricity." This individual had no light in his garage. Needing to do a job there, he ran a lead from a street lamp outside his home over a wall into the garage. A simple system but rather too easy to detect, I should think.

* * *

Announcing a series of lectures on "The Romance of Electricity" the *Reading Mercury* quotes an advertisement in one of its issues in November, 1746, which heralded a demonstration of the effects of electricity. The reader was promised:—

> "All the surprising experiments demonstrating the activity and force of electricity in attraction and repulsion; producing light and actual fire from various substances, especially human bodies. The person electrified emits fire from every part of his body by the approach of another; spirits of wine are fired at a hundred yards distance. . . ."

Electrical phenomena seem to have been quite as romantic then as they are now.

* * *

"Popular Science" describes a new form of heating introduced in the United States. It takes the form of full-colour paintings of country scenes in which electric elements are embodied—a form of panel heating in fact. It might be suggested that the productions of some modern painters generate enough heat to render elements unnecessary.

PERSONAL and SOCIAL

News of Men and Women of the Industry

TO celebrate the fifty-one years' service rendered by **Mr. Harold Denton** to the electrical industry, Oliver Pell Control, Ltd., with whom he has been throughout the period, arranged for him to meet some of his numerous friends at dinner at the Savoy Hotel, London, on 18th December. In the absence of the chairman of the company, Mr. Sefton Turner, on account of ill-health, Mr. Norris Oliver (director) presented the guest of honour with a cheque as a token of the esteem in which he is held. Mr. Oliver recalled Mr. Denton's design of the early magazine flame arc lamp and his subsequent work on windings for electro-magnetic coils. He also referred to the all-pervasive friendliness Mr. Denton conveyed to those associated with him. Others who paid tributes were Mr. Graff Baker (London Transport Executive), Mr. Fitz Harris (managing director, G. V. Carburettors), Mr. Webster, Mr. Sudlow (Varley Dry Accumulators) and Mr. H. Rayner (Igranic Electric Co.).

Mr. J. H. Fraser, B.Sc., A.M.I.C.E., M.I.R.S.E., signal and telecommunications engineer, York, has been appointed chief officer, engineering (signal and telecommunications), at Railway Executive headquarters, London.

Mr. Hugh Beck, B.Sc., A.M.I.Mech.E., M.I.Mar.E., London office manager of Crossley Brothers, Ltd., has been appointed a director as from 19th November last.

Mr. W. G. Scott, general manager of the Perak River Hydro Electric Power Co., is visiting Scotland after twenty-two years in Malaya. Mr. Scott plans to visit hydro-electric developments in Scotland during his six months' leave.

Mr. L. W. Cole has been appointed secretary to Babcock & Wilcox, Ltd., in succession to **Mr. H. B. Clark,** who is to take up special duties with the company as from 1st January.

Mr. A. E. Jepson, Jun., Associate I.E.E., has resigned from H. Fisher (Oldham), Ltd., and has been appointed sales manager of Star Supplies (Domestic & Industrial), Ltd.

Mr. K. A. Thomson has been appointed a director of A. H. Hunt, Ltd.

Mr. W. H. Platt, assistant sales manager (wrought products), is retiring on 31 December, after forty-one years' service in the sales division of the British Aluminium Co., Ltd. **Mr. C. F. Batstone** will combine the functions of principal assistant sales manager with those previously carried out by Mr. Platt, and will have the title assistant sales manager (wrought products).

Mr. D. J. Hopley has been appointed managing director of Oldham & Son (India), Ltd., the recently established associate company of Oldham & Son, Ltd. He succeeds **Mr. Edgar Oldham,** who was seconded to the Indian company to set up its initial organization, and is returning to England to continue his work as chief technical officer, Overseas Control Division of the parent company.

Mr. D. J. Hopley

Mr. Hopley has already taken over at the factory at Saidapet, Madras. Mr. Edgar Oldham is remaining on the board of the Indian company.

Mr. Hopley was educated at Ashby-de-la-Zouche Grammar School. He joined the Royal Air Force in 1935 and trained as a wireless operator, serving for six years in India. After leaving the R.A.F. in 1945, he was engaged on electronically controlled switchgear development work. He has been with Oldham & Son, Ltd., since 1949 as a technical sales officer.

Mr. A. M. Ingram, formerly manager of the slicer division of Crypto, Ltd., will, as from 1st January, take up an appointment as manager of the Leeds branch of Crypto which will continue to control sales and service in the Yorkshire area from 51, St. Paul's Street, Leeds. Mr. Ingram is succeeding **Mr. W. H. Lowth,** the original branch manager, who is now retiring after twenty years' service with the company.

Mr. C. H. Fitter, who, in association with **Mr. J. Poulton,** commenced the business of Fitter & Poulton, conduit fitting manufacturers, Birmingham, in 1919, is retiring at the

of the present month. The concern became mited company in 1923. The business will carried on under the guidance of Mr. lton.

Bruce Peebles & Co., Ltd., Edinburgh, nounce the appointment, as from 1st nuary, of **Mr. P. Butler**, B.Sc., M.I.E.E., **Mr. W. B. Laing**, M.I.E.E., Assoc. iot-Watt College, as joint general managers the company, with responsibility to the naging director. Mr. Butler and Mr. ing have had a long association with the mpany and are well known as departmental nagers in which capacity they, in their spective spheres, have been intimately nnected with the expansion in the company's nsformer, rectifier and rotating plant siness.

Permaheat, Ltd., informs us that **Mr. G. T. Jones** has relinquished his position as director and secretary of the company.

Dr. **J. A. Sugden** has been appointed research and development engineer of the V.G. Manufacturing Co., Ltd., makers of porcelain and refractories.

Nearly 200 members and guests attended the annual dinner of the **Bristol Electric Club** on 10th December. Among the principal guests were Mr. F. C. Meredith (city architect), Dr. Parry (medical officer), Judge Wethered, Commander Walker, R.N.V.R., and representatives from the Exeter, Newport and Plymouth Electric Clubs. The musical programme was provided by a number of popular broadcast artists. The annual dance of the Club held in October produced £200 for the Electrical Industries Benevolent Association, and the collection taken during the dinner realized £35 10s.

Mr. David Higgs, B.Sc., son of Mr. Walter Higgs, chairman of Higgs Motors, Ltd., has been elected a director of the company. Mr. David Higgs was educated at Oundle and took his degree at Birmingham University. He served two years in the Forces, part of the time in Egypt, and has recently returned from a year's technical survey of the United States where he visited eighty-four firms manufacturing electrical machinery and complementary equipment.

Mr. David Higgs

The annual dance of **Venner Time Switches, Ltd.**, was held on 14th December, when to the music of Eric Taylor and his Knightriders some 200 couples took the floor. Spot prizes and other novelties added to the festive spirit of the occasion. On the following day a party was given for the children of employees. After tea Mr. S. P. Kendon (Venner film section) showed a Laurel and Hardy film, followed by a Mickey Mouse cartoon. Then "Father Christmas" appeared on a sleigh and distributed presents to some 240 children who also received an orange and sweets before going home.

OBITUARY

Mr. W. Stuart Curry, purchasing officer, South East Scotland Division, British Electricity Authority, died on 15th December at the age of fifty-nine. Mr. Curry was educated at Armstrong College, and received his training with A. Reyrolle & Co., Ltd. In 1913 he was appointed engineering assistant with the Victorian State Railways, Australia, and returned to this country in 1916 to take up the position of senior draughtsman (turbines) with C. A. Parsons & Co., Wallsend. He joined the South Shields Corporation Electricity Department in 1918 as chief draughtsman, and was subsequently with the Liverpool and Carlisle electricity undertakings, before joining the Ayrshire Electricity Board in 1930 as superintendent of sales, stores and transport, a position he held until nationalization.

The late Mr. W. S. Curry

Mr. Frederick William Field, former illuminations engineer, Blackpool, who was largely responsible for making Blackpool's illuminations nationally famous, died on 17th December at the age of seventy-one. Mr. Field, who retired in 1946, was with the Blackpool Corporation for forty-seven years, and in his earlier years was mainly concerned with the transport system, being at one time resident electrical engineer of the Transport Department. Although he retired in 1946, he returned to organize the first post-war illuminations in 1949.

Mr. Harry Barlow, whose death occurred on 17th December at the age of thirty-seven, had been representative in the Northumberland and West Durham area for Adamson & Co. (Tyne), Ltd., electrical wholesalers, for some years.

Mr. William Simkin, northern area manager for Monks & Crane, Ltd., died on 3rd December at the age of forty.

NEW BOOKS

Training and Promotion in Nationalized Industry. Pp. 138. Published by George Allen & Unwin, Ltd., Ruskin House, 40, Museum Street, London, W.C.1, for the Acton Society Trust. Price 10s 6d.

This book is based on research by the staff of the Acton Society Trust (whose studies of nationalized industries have been mentioned in the *Electrical Review*), aided by a study group representative of members of personnel departments of national boards and of large private undertakings, trade unionists, etc.

After an introductory chapter a section is devoted to the structure and staffing of the industries concerned and then training programmes and policies are dealt with under the headings vocational, promotion, supervision and management. In this section the arrangements established by the British Electricity Authority and Area Boards are covered. Reference is made to the courses provided at Buxton and Horsley Towers for various classes of employees and to the summer and Easter "schools" at Oxford and Cambridge.

A similar board-by-board treatment is accorded to the subjects of the progress of training, promotion methods and policy, and the organization of personnel departments. The method adopted facilitates comparison of the various systems.

Other chapters deal with problems of promotion policy and procedure and of personnel organizations and there is an adequate index. The book should be of interest and use to private as well as public concerns.—J.H.C.

Small Non-Commutator Motors. By W. L. McDougal and K. C. Graham. Pp. 265; figs. and index. Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey. Price 35s in U.K.

This book deals with all types of single-phase motors with the exception of series motors and those which operate on the repulsion principle. It covers this ground rather fully, since it explains the basic electrical and magnetic principles, testing, rewinding, mechanical details, and fault location, together with notes on speed control and two-voltage windings.

The book will be of little help to a designer who requires assistance in calculating the number of turns and sizes of wire for a given motor; mathematical formulæ are almost entirely absent. A minor criticism is that, in a few places, the text seems to have been rather over-simplified. For instance, certain sizes of capacitors are mentioned without reference to the size of motor, and the reader may gain the impression that a split-phase motor having an external resistor or inductance in series with the starting winding would not start. Amongst other factors the effect would, of course, depend on the resistance of the coupled load.

There is, however, a wealth of practical information in the various chapters, which should be of use to winders, and especially to those with limited experience. The book can be recommended to all apprentice winders, particularly in view of the series of questions, with answers, which are given at the end of each chapter. There are also questions, without answers, which should stimulate interest and enquiry. Apart from the fact that the wire tables refer to American wire gauges the information given applies equally to British apparatus and methods.—J.L.W.

Books Received

The Nature of Polyphase Induction Machines. By P. L. Alger. Pp. 397; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 60s in U.K.

Fractional Horse-Power Electric Motors. By F. G. Spreadbury. Pp. 342; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 35s.

I.E.E. Arrangements

THE annual dinner and reunion of the Institution of Electrical Engineers will be held on 28th February at Grosvenor House, Park Lane, London, W.1, under the presidency of Sir John Hacking.

It is announced that the Council has accepted an invitation from the chairman and committee of the Irish Branch (Dublin) to hold the next summer meeting of the Institution in Ireland. This advance notice should enable members who intend to take part to reserve the dates, which are from 30th June to 4th July, 1952.

Social Duties of Engineers

Problems of Production and Distribution

THE dominating part that can be played by engineers by virtue of their key position and training in a Welfare State which provided full employment was the subject of an address to the Association of Supervising Electrical Engineers on 18th December by Mr. R. F. Mathieson.

Pointing out that in the past 200 years there had been a greater development in man's mastery over nature than in the previous 10,000 years, he said that natural means were no longer enough to enable the human race to adapt itself to changing conditions and that this implied the need for a planned society.

Present social mechanisms were inadequate to meet the problem of bringing back into daily life an interest in the organization of society and the raising of its cultural standards. While those responsible for the planning must make decisions, engineers who were fitted to design and examine mechanisms, ought not to confine their interest to the ballot box.

Encouraging Individual Responsibility

The tendency towards centralization in large units should be reversed so as to encourage a sense of individual significance, without which social co-operation would collapse. Each group of individuals should particularize in fields in which it had special competence; for instance, the A.S.E.E. could vitally contribute to solving the problem of maintaining the mechanisms of production. The essence of the problem was to get men to work, particularly at arduous and menial tasks which formed the basis of high productivity, through finding inner satisfaction in paid employment. This could be done only by shaping social mechanisms to suit the nature of man and allowing him to share in the responsibilities of management.

The sole object of production was consumption, and the more men produced, the more they should be able to consume. Increased mechanization should release men to do other work of a socially desirable nature. It was, however, futile to increase production without improving the distribution mechanism. The aggregate of prices was roughly equal to the money available; an analogy for which existed in Ohm's Law. Moreover, a distribution system without voltage regulation was comparable with a community in which the volume of money was not regulated in an orderly manner.

To illustrate his point the lecturer displayed curves showing the rate of change of money, national income and weekly wage rates since 1920. When production and monetary supply were stable, the national income curve was practically identical with the production curve, but when monetary supply was unduly increased costs of living rose. The curves also showed that the potential production in this country was almost 50 per cent higher than that now reached.

The position was complicated by foreign trade, as since the obsolescence of the gold standard there had been no scientific technique for the exchange of currencies to enable nations to exchange their surplus products. Mr. Mathieson favoured an international system in which payment for imports should be made in the currency of the recipient country, world currencies being related in terms of purchasing power.

Housing Survey

A SURVEY of 173 applicants for Council houses in Saltcoats (Ayrshire) showed that for cooking purposes, 92 preferred gas, 25 electricity, and 56 had no preference. Where electricity alone was installed there was a saving of £3 10s 7d per house. The Electricity Board charged £15 for installing electricity for lighting, but only £3 for all-electric houses, the Town Council was told. While the Gas Board maintained all cookers free for five years, the Electricity Board did no maintenance. In all-electric temporary houses over the last five years maintenance had averaged £1 0s 9d a house each year. The Council has approved a Housing Committee recommendation that the new houses should be all-electric.

Canadian Electrical Industry

MR. M. P. MURPHY, vice-president and managing director of the Northern Electric Co. of Canada, said recently that the Canadian output of electrical apparatus and supplies was expected to exceed $600 million this year. That figure was more than double the Canadian total for 1944 and would exceed the 1950 total by more than $20 million.

Mr. Murphy said it was not the intention of the Hon. C. D. Howe, Minister of Trade and Commerce, to disrupt the electrical industry by defence projects. The Government plan was to place a defence production load of not more than 20 per cent on the industry. However, the additional burden had not developed as rapidly as expected and now represented a load of not more than 3 or 4 per cent. The availability of raw materials and supplies for the industry was creating real problems for the manufacturer. He added that measures for the control of supplies of raw materials were both essential and beneficial, being the only means of ensuring equitable distribution.

Earlier, in Ottawa, Mr. D. Napier Simpson, manager of the Canadian Electrical Manufacturers' Association, said that the electrical industry had hit a slump. He told a special Parliamentary committee on retail price-fixing that higher Government excise and sales taxes were the main reasons for the drop.

In a report just issued the Dominion Bureau of Statistics states that the gross factory value of products manufactured by establishments comprising the electrical apparatus and supplies industry in Canada reached an all-time peak total of $581 million in 1950, 19 per cent above the previous peak of $486 million in 1949. The cost of materials rose almost 23 per cent from $212 million to $260 million and the net value of products advanced 17 per cent from $274 million to $315 million.

Production values for most individual items were higher in 1950 than in the preceding year. Generators and parts rose in value from $8 million to $12 million; motors and parts from $27 million to $35 million; switchgear and protective equipment from $27 million to $30 million; and transformers and parts from $36 million to $39 million. Production of stoves, "rangettes" and cooking plates at $12 million and vacuum cleaners and parts at $9 million was also higher.

Batteries of all types were valued at $28 million (against $26 million); incandescent lamps increased from $10 million to $13 million; radio receiving sets for civilian use from $29 million to $33 million; television sets from $2 million to $8 million; and wires and cables from $76 million to $84 million. Telephone materials, including exchange switchboards, telephones and transmitters, fell in value from £33 million to £30 million.

Diesels for British Railways

DURING the five years 1953–57 it is planned to add 573 diesel shunting engines to the British Railways fleet of locomotives. Of these 432 will be diesel-electric engines of 350 h.p. and 141 diesel-mechanical engines of 150 200 h.p. The present stock of diesel shunting engines is 130 and a further 84 have already been authorized.

The five-year plan is the result of a special investigation into the shunting engine position in all Regions. This showed that economies could be obtained and efficiency increased by changing over from steam to diesel traction in many of the larger marshalling and goods yards and on dock sidings. Progress of the plan, however, depends on the permissible level of investment expenditure, steel supplies, and manufacturers' ability to provide diesel engines and transmission equipment.

As a first instalment 57 of the diesel-electric engines and 12 of the diesel-mechanical engines are to be included in the 1953 locomotive renewal programme. The diesel-electric engines will be of the 0–6–0 type, and there will be two types of diesel-mechanical, namely 0–4–0 of 150 h.p. and 0–6–0 of 200 h.p. Main frames, wheels, cab structure and mechanical parts will be built in the British Railways workshops and the diesel engines and electrical transmission equipment purchased from contractors who specialize in their design.

The advantage of diesel operation in Britain is most marked in shunting yards where employment is continuous, but British Railways are continuing their trials with high-powered diesel locomotives on general passenger and freight working. These include four 1,600 h.p. main line express passenger and freight locomotives; an 800 h.p. diesel-electric unit for secondary passenger and freight services; and two diesel-mechanical locomotives—one of 1,600 h.p. for main line and freight services and another of 500 h.p. designed mainly for local freight trips.

OVERSEAS ELECTRICAL TRADE

Exports in November Higher Than Ever

A FURTHER improvement on October's record figure of £15,299,578 for exports of electrical apparatus nd machinery was recorded last month. he total of £16,899,420 was no less than 1,179,117 above that for November, 950. It must not be assumed, however, hat all this improvement is due to increased rade. The general tendency towards higher prices must be taken into consideration and it is in fact the case that many of the items for which the value of sales has advanced actually show a decline in quantity disposed of.

Reference to Table I, in which the exports are analysed under their different classifications, shows that about half of the £4 million increase in value of exports over

TABLE I.—ELECTRICAL EXPORTS

Class	November, 1951	November, 1950
	£	£
Telegraph and telephone cables and wires (submarine)	25,296	52,400
Ditto, not submarine	469,992	608,173
Wires and cables, paper insulated	611,831	423,757
Ditto, rubber insulated	807,520	426,548
Ditto, cotton, silk or artificial silk insulated	64,541	66,168
Ditto, enamel, glass or asbestos insulated	73,995	115,443
Ditto, other	294,641	173,655
Commercial radio apparatus	595,044	680,149
Domestic radio apparatus	159,608	294,807
Telegraph, telephone and signalling apparatus	1,840,481	1,476,905
Radio loudspeakers	80,243	61,044
Telecommunication components, n.e.s.	633,308	501,409
Other telecommunication apparatus	131,712	111,611
Valves and cathode ray tubes	338,452	289,996
Carbons	30,609	21,877
Lamps, exceeding 24 V	92,436	64,529
Ditto, not exceeding 24 V	56,044	41,046
Other lighting appliances	425,528	345,838
Primary batteries	184,667	147,985
Parts other than carbons	57,510	29,080
Accumulators for motor vehicles	244,033	172,726
Ditto, traction,	19,415	23,560
Ditto, radio	4,171	2,211
Other portable accumulators	46,574	75,656
All other accumulators	41,537	17,077
Parts and accessories	78,889	81,126
Cooking appliances	309,656	151,641
Heating appliances	84,798	75,256
Parts and accessories for cooking and heating appliances	82,947	63,962
Flat irons	78,212	73,902
Commercial electrical instruments	155,947	143,004
House service meters	153,109	99,312
Time recorders and time switches	8,098	10,981
Other electrical instruments	105,453	120,426
Electro-medical apparatus (not X-ray)	51,013	57,904
X-ray apparatus, tubes and parts	222,630	120,878
Permanent magnets	26,848	28,237
Insulating cloth and tape	129,063	79,681
Other insulating materials	125,855	86,317
Unclassified electrical goods and apparatus	638,698	333,217
TOTAL electrical goods and apparatus	9,877,707	7,749,494
Diesel driven generators not exceeding 200 kW*	462,372	384,886
Ditto, exceeding 200 kW*	139,934	152,144
Other generating sets*	122,518	165,253
Generators exported without prime movers, and parts of generators†	386,792	283,132
Motors, railway, tramway and trolley bus	6,399	10,541
Ditto, other, not over ½ h.p.	160,510	107,823
Ditto, over ½ h.p. but under 1 h.p.	75,284	13,963
Ditto, from 1 h.p. to 250 h.p.	551,791	452,235
Ditto, exceeding 250 h.p.	77,932	74,890
Ditto, parts	91,855	103,615
Converting machinery	38,245	17,782
Transformers, including coils	1,024,446	691,554
Rectifiers for power house use	44,029	76,829
Motor starting and controlling gear	224,913	199,318
Switchgear and switchboards (not telegraph and telephone)	1,605,461	899,389
TOTAL, electrical machinery	4,992,451	3,963,352
Washing machines (not exceeding 250 lb weight)	930,223	384,508
Ditto, parts	45,642	26,912
Vacuum cleaners	302,561	188,119
Ditto, parts	51,991	58,097
Other electrically operated portable appliances and parts	280,664	130,643
Portable electric tools	103,588	120,549
Unspecified electrical machines, machinery and parts	314,593	98,629
GRAND TOTAL	16,899,420	12,720,303

* The 1950 figures include generators without prime movers

† The 1950 figures are for parts of generators only

the November, 1950, figure is provided by sales of electrical goods and apparatus, a quarter by generators, motors, transformers, rectifiers, switchgear and control gear and the remaining quarter by other electrical machinery, including such items as vacuum cleaners, washing machines and tools.

As shown by Table II, Australia (£1,119,082), South Africa (£982,632) and India (£870,995) head the list of buyers of electrical goods and apparatus. Somewhat disappointingly sales have fallen both to Canada (from £350,401 to £246,617) and the United States (from £142,531 to £83,607).

Although electrical machinery exports as a whole show an advance of about £ million, shipments of generators declined from £1,285,415 to £1,111,606 despite bigger buying by Australia (£307,65 against £161,269) and India (£148,82 against £96,683). The decrease is due mainly to reduced purchases by Russia (£5,017, against £191,339), South Africa (£52,551, against £164,612) and Portugal (£24,801, against £118,282). Australia and South Africa accounted respectively for £194,936 and £142,320 of the £943,75 worth of motors exported. South Africa (£716,420), Australia (£580,129) and India (£307,244) were the best markets for "other electrical machinery."

Table II. Distribution of Electrical Goods and Apparatus

Destination	November, 1951	November, 1950
Channel Islands	65,968	32,548
Gibraltar	8,592	56,095
Malta and Gozo	9,973	9,900
Cyprus	24,663	11,558
British West Africa	170,371	108,797
Union of South Africa	982,632	588,229
Northern Rhodesia	34,344	16,667
Southern Rhodesia	147,924	80,081
British East Africa	317,775	153,108
Bahrein, Kuwait, Qatar and Trucial Oman	52,542	20,847
India	870,995	651,691
Pakistan	191,953	186,596
Malaya	426,821	206,492
Ceylon	171,755	114,034
Hong Kong	279,936	126,571
Australia	1,119,082	994,599
New Zealand	730,094	474,983
Canada	246,617	350,401
British West Indies	145,881	73,122
Anglo-Egyptian Sudan	64,371	17,485
Other Commonwealth Countries	99,577	46,163
Irish Republic	618,773	309,255
Soviet Union	33,940	28,483
Finland	62,445	25,941
Sweden	288,046	258,097
Norway	154,682	172,225
Iceland	41,512	12,375
Denmark	112,049	156,110
Poland	35,973	51,090
Germany	47,034	38,138
Netherlands	242,341	267,478
Belgium	122,768	132,264
France	106,905	121,730
Switzerland	39,743	61,298
Portugal	83,597	138,947
Spain	29,676	34,412
Italy	79,986	81,758
Austria	50,536	74,913
Hungary	5,975	3,577
Czechoslovakia	17,163	9,326
Greece	44,666	44,280
Turkey	56,375	20,110
Indonesia	46,441	9,398
Portuguese East Africa	13,667	12,249
Syria	17,044	17,090
Lebanon	41,953	17,134
Israel	53,974	15,414
Egypt	149,732	246,951
Arabia	56,539	1,581
Iraq	66,049	135,782
Iran	6,563	101,710
Burma	56,666	18,206
Thailand	23,012	22,902
China	23,314	20,262
United States of America	83,607	142,531
Colombia	10,190	17,140
Venezuela	70,742	27,047
Peru	27,086	77,740
Chile	29,481	15,532
Brazil	255,547	202,117
Uruguay	17,625	17,813
Argentine Republic	190,791	102,409
Other Foreign Counties	201,630	136,712
Total	9,877,707	7,749,494

Although sales of generators declined from £1,285,415 to £1,111,606 despite bigger buying by Australia (£307,65 against £161,269) and India (£148,82 against £96,683). The decrease is due mainly to reduced purchases by Russia (£5,017, against £191,339), South Africa (£52,551, against £164,612) and Portugal (£24,801, against £118,282). Australia and South Africa accounted respectively for £194,936 and £142,320 of the £943,75 worth of motors exported. South Africa (£716,420), Australia (£580,129) and India (£307,244) were the best markets for "other electrical machinery."

Damages for Electrician

AT Lewes Assizes recently Mr. Justice Sellers awarded damages of £526 to Mr. R. W. McConnell, an electrician employed by Gypsum Mines, Ltd. The *Hastings and St. Leonards Observer* reports that while Mr. McConnell was working on a "live" switchboard he was burned about the hands, arms and face. A medical report was put in to the effect that the plaintiff was still liable to soreness and cramp and there might be some permanent effect.

The evidence showed that the plaintiff, when instructed to connect some cables to the switchboard, asked for the current to be cut off, but was told that it was impracticable as it would bring operations at the gypsum mine to a standstill. Plaintiff's counsel contended that there had been a breach of regulations by the company. This was denied and the defendants imputed contributory negligence to the plaintiff.

Mr. McConnell admitted that he knew that he was undertaking something that was potentially dangerous but he did not want to get himself into an awkward position by refusing to do the work. A foreman stated that he had told the plaintiff to do the work at the week-end when the machinery was not running. He agreed, however, that he and other men had worked on live equipment at the mine.

In finding for the plaintiff, the Judge said that the work should have been specifically arranged to be done when the mine was not working. The sole responsibility must remain with the defendants whose liability it was to make such arrangements.

"Vintage Years"

Recollections of Some Electrical Pioneers

By D. B. WELBOURN, M.A. (Cantab.), A.M.I.E.E.

THE arrival of a new "Molesworth" sent me the other evening to the shelf where my unused but not discarded technical books are kept. There, tucked in a corner, was "Molesworth" 23rd edition inscribed on the flyleaf "B. Welbourn, King's College, London, Nov. 1896"; and next to it was Silvanus P. Thompson's "Dynamo Electric Machinery" inscribed "J. M. Donaldson." Both the signatures bear traces of a grounding in a copper plate style which they were to lose as they became better known.

What a world of giants those signatures evoke, the world of the London Colleges in the 'nineties where were studying a large proportion of the men who were to form the electrical industry as we know it to-day. Among the teachers were John Hopkinson and Ernest ("Freddy") Wilson at King's College, Perry and Ayrton at the City & Guilds, Silvanus Thompson at the Finsbury Tech., and Alexander Russell at Faraday House. Gisbert Kapp, however, was still Mr. W. H. Allen's designer for machines for supplying electricity to "the new light" as it was called in his firm's order book.

The Students

And the students? J. R. Beard, J. M. Donaldson, A. P. M. Fleming, J. S. Highfield, P. V. Hunter, E. W. Marchant, C. C. Paterson, C. H. Wordingham (later Director of Electrical Engineering at the Admiralty) and Duddell of oscillograph fame all became presidents of the Institution of Electrical Engineers while Francis Lydall, Alexander Kennedy, C. H. Merz, W. McLellan, Robert Nelson, G. H. Nisbett, Lord Verulam, Miles Walker and B. Welbourn, were there too. A search through the lists of students of that time would reveal as many more and show how that ferment of ideas in the London Colleges shaped the future of electrical engineering.

It is worth considering what these men had in common which led to the phenomenal development of the electrical industry. To an engineer half a lifetime younger, it appears that the greatest attribute which they brought to the industry was youth in positions of high responsibility; J. M. Donaldson, in his twenties, was chief engineer of what was later to become "Northmet" and when B. Welbourn became contracts manager of "British Insulated," at the age of 25, the chief engineer and oldest member of the technical staff was G. H. Nisbett, aged 32. Lord Radcliffe of Werneth in his Reith Lectures has recently commented on the youth of many of the early administrators who built up the Indian Empire; does age and experience in high places really build better?

First-Class Training

The other great attribute, possibly more important than youth and certainly less common in the engineering world of that time, was a first-class scientific training. They were fortunate to enjoy it in a rapidly developing subject when the body of knowledge to be mastered was still within the capacity of a single man to grasp in a reasonable time, and when attention was concentrated on fundamentals and the methods available for tackling new problems. In addition to their scientific education they were able in London to obtain a wide general education on very modest means; at least one recalls the glories of hearing Patti and the de Reske brothers from the "gods" at Covent Garden, and the badness of even the best orchestras of that period.

The influx of these young men at the turn of the century into the young industry made it unique in the engineering world. Only the growth of the aircraft industry has offered any parallel. Over most of the engineering field theory has until recently lagged behind practice, but in both these industries practice has lagged behind theory since "common sense" is not a powerful weapon for the untrained when tackling alternating current or aerodynamic problems. Has it been mere chance that

the electrical industry with its high proportion of university graduates has been so free from labour trouble?

Professor Ayrton, I believe, retorted to a young man who said that he wanted to become an electrical engineer: "You can't; you can be an engineer, but the qualification has no meaning." After almost fifty years in the electrical industry one of its leading members commented that he supposed that he was considered to be one of the leading electrical engineers in the country, yet he had spent 90 per cent of his time on problems involving men, 9 per cent on the most diverse aspects of mechanical and civil engineering and perhaps 1 per cent on specifically electrical problems.

Perusal of the *Proceedings* of the Institution of Electrical Engineers to-day would scarcely suggest this formula for the way in which an electrical engineer spends his time, while one engineer must sadly confess that it is an exciting occasion when he discovers that he can understand even one paper in a new number of the "Electricals" *Proceedings*, although those of the "Civils" and "Mechanicals" still remain relatively intelligible.

The 'nineties in London were indeed vintage years for our industrial development; we can only hope that some of the creators of an industry will write their recollections of it before it is too late and that also before it is too late some engineering historians may be found to study and record a chapter in our history as important as any that has been written, the history of the birth of the industry which has provided the key to the atomic age.

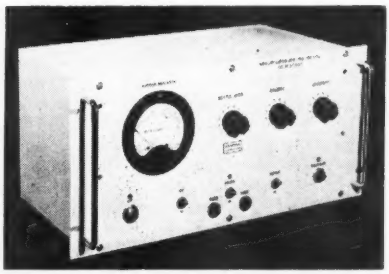
Mercury Vapour Detector

AN instrument indicating the amount of mercury vapour in an enclosed atmosphere either continuously or at intervals has been developed by Hanovia, Ltd., Slough, Bucks. The principle employed is the absorption by mercury vapour of ultra-violet rays at a wavelength of 2,537 Angstrom units. A low-pressure mercury resonance lamp is mounted at one end of a cylindrical chamber, the intensity of its radiation being recorded by a photocell at the other. The chamber is kept replenished by air drawn from the atmosphere to be tested by means of a blower.

With clean air present the photocell will record maximum intensity, this being indicated by the zero reading on the microammeter on the front of the instrument. Any admixture of mercury vapour reduces the transmission of ultra-violet rays along the cylinder and lowers the activity of the photocell. By means of a bridge circuit any decrease in the photocell response gives a positive reading on the microammeter which can be operated on two different scales: 0 to 1,400 and 0 to 100 micrograms of mercury per cubic metre of air.

In use the mercury resonance lamp and air intake blower are kept running. Inlet air comes through rubber piping the free end of which is taken into clean air (for calibration purposes) or to the test area; piped connections can be arranged so that the meter is used at a single control point covering several departments in a large building.

Hanovia mercury vapour detector



Electric Lifts

BRITISH Standard Code of Practice CP 407.101 (1951), drawn up by a committee convened by the Institution of Mechanical Engineers, is a revision of the draft Code previously issued. It deals with the installation in flats, shops and department stores, hospitals and industrial premises of electrically operated passenger, goods and service lifts. It indicates the information which should be exchanged between interested parties and the sequence of events from the inquiry stage to the handing over of the installation. The Code carries the usual warning that in the present abnormal conditions it may not be practicable to carry out all the recommendations. Copies are available from the British Standards Institution, 24-28, Victoria Street, London, S.W.1, price 4s. post free.

Transformer Oils

I.E.E. Supply Section Papers

At a Supply Section meeting of the Institution of Electrical Engineers in London last week two papers on transformer oils were presented and subsequently discussed. The first, by Mr. W. R. Stoker (Shell Petroleum Co., Ltd.) and Mr. C. N. Thompson (Thornton Research Centre, Shell Refining and Marketing Co., Ltd.) dealt with inhibited transformer oil. For the evaluation of this type of oil new and more informative oxidation tests are required. The authors gave a brief description of these together with some results obtained in the laboratory, in trials with small transformers under laboratory conditions and with transformers in service. They had found that it was possible to distinguish between contamination and deterioration of oil in service and to assess the rate of decrease of oxidation stability of the oil.

After discussing questions arising from the use of inhibited oils it was concluded that at present their greatest value would be in distribution transformers, particularly those which had given trouble because of oil oxidation, rather than in large transformers or in switchgear. With more practical experience of the superior oxidation stability of these oils smaller and cheaper transformers might become possible.

Oil Stability

The second paper, which dealt with stability of oil in transformers, was presented by Mr. P. W. L. Gossling (W. B. Dick & Co., Ltd.) and Mr. L. H. Welch (London Electricity Board). The authors summarized operating experience with transformer oils from the aspect of sludge formation and the increase of acidity with life, and described tests designed to study the correlation of increasing acidity found in service with prediction of performance based on the Michie sludge test. Acidity values were discussed from the aspect of working conditions and transformer site, the results indicating a trend toward greater deterioration of oils yielding higher acidity values in the sludge test, and B.S. 148: 1933 has been revised to exclude such oils. It was concluded that under normal operating conditions oils complying with B.S. 148: 1951 might give satisfactory service with the minimum of maintenance for the whole of the expected life of the transformer.

DISCUSSION

Mr. J. W. Leach said that the instability of oil was closely associated with the temperature at which transformers were operated. A large number of transformers had never been more than lightly loaded, and their temperatures had been correspondingly low. One of the ways of cheapening the cost of electricity was to cut capital charges, which meant paralleling the transformers and the networks and getting a better loading of the transformers, which in turn would lead to higher temperatures than in the past. If a thoroughly stable oil could be obtained, it would be possible to make a very substantial cut in costs.

Mr. E. A. Evans said that the former repugnance of the transformer makers to accept anti-oxidants was waning, and he hoped that before long anti-bodies would be accepted freely in transformer oil, as they were in turbine oil and internal combustion engine oil.

Dr. J. S. Forrest's only criticism of the paper by Messrs. Stoker and Thompson was that the authors had omitted to give information on the nature of the inhibitor used and the concentration in which it was employed. The wide use of inhibited oils in the United States was a fairly recent development, and he was not sure that American manufacturers had wholeheartedly gone over to inhibited oils even yet. A factor which should be remembered when comparing British and American practice was that it had been stated that the oils commonly available in America oxidized more readily than the oils available here. Accordingly, there was more scope in America for the use of inhibitors.

Mr. A. W. Thompson remarked that

there were many difficulties in the way of the general adoption of inhibited transformer oils. Not the least was the fact that the existing transformer oil to B.S. 148 was proving completely satisfactory in all types of transformer and might well outlast the life of the transformer. The people most concerned about improving transformer oils appeared to be the oil manufacturers, and on the whole the electrical industry was well satisfied. There was evidence of a very healthy state of affairs in the oil industries, and it was to be regretted that other components of the transformers had not been the subject of the same enthusiastic efforts towards improvement. For example, the varnishes used and their possible reactions upon oil oxidation had never been properly studied. Another difficulty was the problem of incompatibility of oils containing different inhibitors. It was probable that no engineer using transformer oil would look very kindly upon an inhibited oil if he did not know exactly what the inhibitor was.

Mr. E. A. Howes maintained that the advantages of using inhibited oils were not as widely known as they deserved to be. It was difficult to understand the reasons for some of the antagonism that existed to-day. The physical properties of metals were profoundly influenced by small additions of other elements, and the chemist, in making similar contributions in the field of oil technology, was taken aback when the reception accorded to them was that they were regarded as a commercial racket of oil manufacturers.

Cost of Inhibited Oils

In the past, high charges had been made for inhibited oils, and this was perhaps one of the reasons why prejudice had arisen and still existed. To-day, although research and development must be paid for, generally speaking there was and should be only a few pence difference in cost. The advantages to be gained quickly offset this charge, or alternatively it might be regarded as an insurance premium, particularly if tests were only to be conducted every one or two years. The competitive spirit of private enterprise necessarily shrouded the chemical configuration and constitution of inhibitors, so that only if they passed into disuse was the identity revealed. This had undoubtedly resulted in building up an atmosphere of mumbo-jumbo. The paper by Messrs. Stoker and Thompson should go a long way towards dispelling doubts and prejudices which could and did operate against the interests of the national economy.

Mr. V. Biske, referring to the difficulty of flushing and cleansing dirty transformers before they were refilled with fresh oil, said that better results might be obtained by using, as a cleaning fluid, a material having definite solvent properties with regard to transformer oil sludge. The petroleum industry had now available a highly aromatic material which was within the boiling range of transformer oil itself—aromatic solvent extracts which could be obtained in the refined form and which had found several uses in industry. The physical characteristics of certain of these extracts with respect to viscosity, flash point and pour point were very similar to those of transformer oil, but owing to their highly aromatic character they could have an appreciable solvent effect on sludge.

Troubles Due to Varnishes

Mr. W. J. Renwick referred to the way in which the authors attributed certain troubles to varnish constituents, and said that it would have been of great assistance in arriving at a proper appreciation of the tests if the varnish impregnations had been specified.

Mr. G. O. Castell felt it was only fair to say that a great many varnishes had been tested; some had given bad results, some less serious results, and some had been absolutely neutral when used in oil.

Mr. E. Tobin also felt that there was no reason to put the blame upon varnish at the present time, since many manufacturers had studied the problem for years and were eliminating all the materials that could cause trouble. He considered that there was a great deal of benefit to be gained from filtering oil in the early stages of the life of the transformer. If this were done, any moisture and dirt that might have got in during erection could be disposed of, and this would give some improvement in the life of the oil.

Mr. P. W. L. Gossling, in a brief reply, agreed that varnish had greatly improved, and it was possible that the wide differences in the behaviour of transformers in the same chamber and under the same operating conditions would not occur at all frequently at the present time. It was, he said, a little difficult to refer to American

ansformer oils, since there was no published ecification. He would have no serious jection to the use of aromatic extracts for ashing, but while it was probably true at there was no adverse effect upon the S. sludge test even though 5 or 10 per nt of these materials were present, it ould be emphasized that the question of e balance of oils to give a proper auto-ardant effect depended upon the timum proportion of the desired hydrocarbons, and anything which left another material, particularly one of a strongly aromatic type, present in very large proportions might well upset the balance needed.

Mr. W. R. Stoker, who also replied, observed that the objection of incompatibility was always raised when a new range of additive type oils was introduced, but in practice difficulties of that sort were very rare.

Speech Equipment at St. Paul's

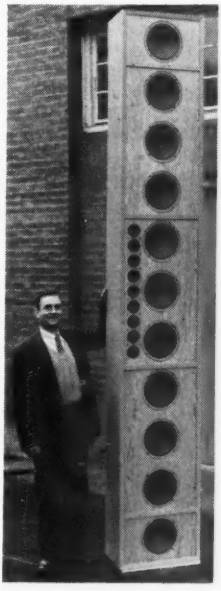
A NEW speech reinforcement system is being tested in St. Paul's Cathedral. This is a particularly difficult building for speech because of its reverberant acoustics. The reverberation time is 12 sec in the empty Cathedral as compared with 4 sec in the Royal Albert Hall or 2·25 sec in the Royal Festival Hall. The new system makes use of two recent developments: the loudspeaker column and the time delay.

The human voice or the sound from an ordinary loudspeaker spreads out more or less equally in all directions. This means that while some of the sound goes straight to the listener in the Cathedral most of it reaches him by reflection from the various surfaces after a considerable time interval. If most of the sound could be directed towards the listener the reflected sound would be negligible. This can be done by using a loudspeaker column comprising a number of ordinary loudspeakers placed in a vertical line. By reason of an interference process this produces a beam of sound spreading out equally in all directions in the horizontal plane but confined within a few feet in the vertical plane.

In the Cathedral, one such column is placed next to the pulpit and the sound directed toward the congregation in the dome area. It has a limited range and therefore additional columns are installed down the nave.

A listener at the east end of the nave may be about 20ft from one of the loudspeaker columns in the nave and 120ft from the one next to the pulpit. With an ordinary amplification system the sound from the nave would reach him about 0·1 sec before that from the pulpit. Since it is the sound which arrives first which determines the apparent direction of the source (the Haas effect) the listener would think that all the sound was coming from the nave loudspeaker. If an electrical delay of just over 0·1 sec is introduced into the nave loudspeaker, the sound from the pulpit loudspeaker will reach the listener first and he will think that all of the sound is coming from that source. This has been done in the Cathedral and the illusion that all of the sound is coming from the pulpit can be maintained over the whole congregation area.

The system, which is still partly experimental in that the final tests can only be made with a congregation present, has been designed by the Building Research Station of the Department of Scientific and Industrial Research in collaboration with Pamphonic Reproducers, Ltd.



One of the loudspeaker columns as used in St. Paul's Cathedral

Fraserburgh Electrical Exhibition

OVER 6,000 people in Fraserburgh (population 10,444) visited the North of Scotland Hydro-Electric Board's "Electrical Efficiency Exhibition" which was held in the town from 11th to 14th December. The exhibition was designed to show the efficiency of electricity, particularly in the home, and displays, demonstrations, film shows and competitions were focused on this aspect of electrical appliances.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Boards and Districts

MR. WALSH'S thoughtful article in your issue of 30th November and the subsequent letters to which it has given rise seem to have overlooked that ubiquitous, although generally forgotten, element, the human one. Although it may be an amusing mental exercise to discuss the economies which would result from disbanding any of the offices in the chain of command from the B.E.A. downwards, the actual savings would be very small indeed if such a step were taken.

These offices are not staffed by typewriters and adding machines but by people, and it is by dispensing with their services that the real economies envisaged by the reformers can be obtained. But it is unlikely that any of them seriously considers either the possibility or desirability of large-scale discharge of staff, many of whom are highly paid, experienced and of great value to the industry. What then would become of them? They would, I suggest, be absorbed by those offices immediately above or below the ones eliminated, with a corresponding absorption of the hoped for saving.

The buildings used as offices are in many cases old country houses, bought and renovated and extended at considerable expense. These will not easily again be disposed of nor will they cease to be a charge on the Boards by the mere fact of their being empty.

It is too late to conduct dangerous and doubtful experiments of this sort. The Authority has built its pyramid and now it must lie in it. D.S.C.

I THINK your correspondent, Mr. Honick, has put into words, in your issue of 7th December, that which hundreds of engineers have been thinking but for obvious reasons do not raise their voices in protest. I refer to the duplicate organizations, namely, the Divisions and the Area Boards. Not only does this apply to the administration but it appears again and again on the engineering side; a couple of examples will illustrate my point.

In the great majority of power stations part of the main switchboard is maintained by the Area Board and part by the Division; a fault, say on the switch wiring (which is often common to all panels), would require the attention of the technical staff of both organizations. Certain transformers are maintained by the Area Boards and others on the same site by the Divisions, which also calls for unnecessary duplication of staff.

Before vesting day there existed many undertakings which carried out the combined functions of generation and distribution over very large areas and made a handsome profit despite the appendage of the C.E.B. This latter body limited the undertakers' generating plant extensions in order to force them to use the grid and should therefore shoulder some of the blame for the present plant position. Now this appendage seems to have taken charge and is "wagging the dog." The planners in London are now arranging to split these large networks at colossal expense in order, I presume, to justify their latest monstrosity, the unnecessary 275 kV grid. Generating plant is wanted, not overhead lines.

Why not let the Area Boards be responsible for their own generation and use the existing grid for its original purpose—to cover emergency breakdowns of generating plant?

As Mr. Marsh stated in your issue of 30th November, the suggestion that distribution and generation should be separate organizations certainly needs further investigation, and by an independent body with no axe to grind.

Sussex. "CHEAP AND ABUNDANT."

Staff Location Systems

INSTALLATIONS of this kind are dealt with in CP327.402 (1951) now issued in its final form by the Council for Codes of Practice for Buildings as part of the series concerned with telecommunication services in and about buildings. Copies are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 3s, post free.

Natural Steam in New Zealand

Progress of Experiments

By Our Sydney Correspondent

NEW Zealand may soon make an important advance in the production of electric power—the generation of electricity by harnessing natural steam in the thermal region of the North Island. For more than a year Government engineers have been sinking bores and testing the steam pressure thus obtained. It was lately announced that a turbine generator is soon to be installed at one of these bores.

Local use of this steam is not new. The Maoris employed it crudely for cooking, and enterprising early settlers piped it to their houses. For half a century or more, steam from fissures in the ground and hot water from geysers have supplied heat and provided medicinal baths in Rotorua and at Taupo and Wairakei, the smaller tourist resorts, on the region's southern fringe.

At first, the post-war studies of the geophysicists attracted little public attention. But by 1948 the shortage of hydro-electric equipment in New Zealand and the expanding demand for power in industry caused interest to heighten. The Government, encouraged by Italian success in this direction, told the Department of Scientific and Industrial Research to go ahead with the extension of field research. Wairakei is the theatre of the experiments. The little geyser valley, nestling in bushclad hills a few miles from New Zealand's largest lake—Taupo—and the township of that name, has long been noted for the intensity of its thermal activity.

Geological Structure

A hard, thick shell of sub-surface pumice rock in this part appears to form, as it were, the lid of an enormous cauldron containing and compressing steam formed by the subterranean heating of water. This water is believed to seep from the bed of Lake Taupo and the Waikato River, which flows out of the lake at a point close to Wairakei. Here and there—in the geyser valley, along the foothills and even by the banks of the chill, fierce running Waikato—steam escapes from the subterranean cauldron, through natural vents.

Natural steam borehole at Karapiti, New Zealand

Chief among these district "safety valves" is the Karapiti Blowhole, a hillside vent some 9in in diameter, from which superheated "dry" steam escapes at high pressure. Karapiti has blown unceasingly for a recorded century and more, probably for very much longer.

Creating Artificial Blowholes

The experiments at Wairakei comprise the sinking of bores so as to create artificial blowholes of even greater power than Karapiti, and eventually to drive the turbines of electric generators. The method is similar to that of boring for oil. Two of the most important pioneer bores, each 8in in diameter to a depth of 600ft, were completed in March of this year. Since March other, deeper, bores have been sunk. One was drilled to a depth of 1,170ft. All are active, but the experiments are continuing, for the geophysicists expect to tap dryer steam at still higher pressure. A month ago I visited the experimental area and found that the bores were at full blast. Heavy steel pipes, emerging from concrete emplacements, had been curved so as to project horizontally for 20 to 30ft clear of the valve mechanism at the top of the bores.

From the end of each pipe steam was gushing forth in a 12ft jet, then billowing out into a cloud of vapour which was saturating a quarter of an acre of bush and scrub. The geophysicists are endeavouring to prove that the additional tapping of the great subterranean cauldron does not result in loss of pressure. So far, there is no sign of this. Pressure at every bore is constantly being checked; it is not diminishing, nor is it considered likely to do so. In October it was announced by the New Zealand Government experts that the next stage in the project need not be delayed long. As a beginning a 10,000 kW plant is to be installed at Wairakei, where one 4in bore alone has an estimated output of 15,000 kW. It has been blowing for more than six months and to-day there are twelve such bores active in the district.

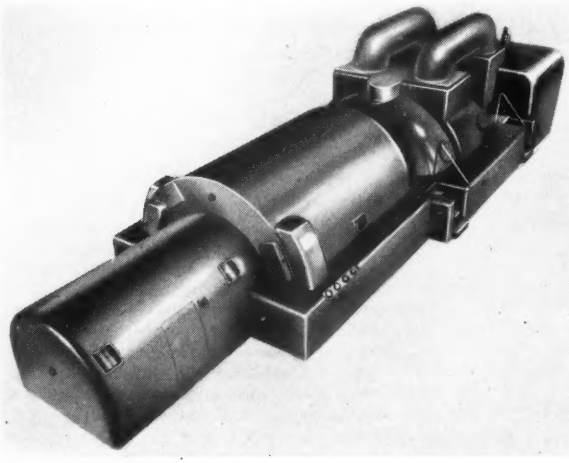
Supercharged Generator

THE November issue of *Electrical Engineering*, the journal of the American Institute of Electrical Engineers, contains a description of a supercharged generator which has just been installed at the Edgewater plant of the Wisconsin Power and Light Company at Sheboygan, Wis. This Allis-Chalmers machine is driven at 3,600 r.p.m. by a steam turbine and generates 60 MW at 12,500 V. It embodies a new principle which is claimed to save some 30 to 40 per cent of the material of a normal machine of this size.

The reduction in weight and length is achieved by forcing hydrogen, at a much higher velocity than has been used before, directly over the surfaces of the rotor conductors. In addition to the normal fans for circulating hydrogen it has a two-stage centrifugal compressor, which is very much like an oversized aircraft supercharger, mounted at one end of the rotor shaft supplying gas to the rotor. To extract heat from the rotor more quickly specially shaped copper windings have been devised through which cool hydrogen travels at high speed.

After being heated in passing through the rotor the hydrogen is cooled by conventional water-to-hydrogen heat exchangers. The heat removing ability of the supercharged machine is demonstrated by the fact that in less than 0·02 sec hydrogen passes through the full length of the rotor passages while at the same time its temperature is raised to 90 deg F. Apart from the saving in copper and steel effected by the design it is claimed that future power stations will be smaller and cheaper owing to the shorter rotor and reduced rotor removal space required. Foundations would also be simpler and smaller. With machines of this type short circuit currents are reduced substantially, with consequent saving in the cost of circuit breakers, reactors, etc.

The change from air to hydrogen cooling, first introduced about sixteen years ago and now universally used in machines of this type, accomplished a 20–30 per cent increase in ratings for an equivalent frame size. By comparison supercharged cooling has in one step raised generator ratings a further 70 per cent without any increase in the amount of active material required. It is likely that future developments may well increase this gain.



This supercharged generator now in use in America embodies a principle which saves 30-40 per cent of the materials of a normal 60 MW machine

Commerce and Industry

B.I.F. and the Export Drive

Domestic Water Heating Code

THE importance of the British Industries Fair in our export drive is emphasized by Mr. P. Thorneycroft, M.P., President of the Board of Trade, in an article which is being circulated to papers published overseas. After outlining its scope and the facilities available to buyers from overseas, Mr. Thorneycroft says that the claims of defence on engineering capacity will not allow us to do all we should like to promote our export trade at the present time.

There are also raw material problems to be overcome as a result of world shortages. But there are special reasons why Britain should maintain its exports while carrying out the defence programme. The British Isles lack almost all the raw materials essential to an industrial country and at the utmost can only provide a bare half of the food needed to keep the population fit. Our economy depends on our being able to pay for vast essential food and raw material imports. Special attention is therefore being given to the needs of export industry. He urges buyers from overseas to make the journey and find out by personal inspection how far we are able to offer goods which are scarce or unobtainable from other sources.

Lighting for Cigarette Manufacture

In the cigarette manufacturing department of the new extension of George Dobie & Sons, Paisley, manufacturers of "Four Square" cigarettes and tobaccos, 360,000 cigarettes are produced every working day by each machine. The lighting for the extension, which includes the tobacco cutting, blending and leaf stripping departments is provided by "Metrovick" 5ft 80 W fluorescent tubular lamps in single-lamp trough reflectors mounted 10 ft above floor level. This gives a service illumination of 10/12 lumens per sq ft. James Kilpatrick & Sons, Ltd., Paisley, were responsible for installing the equipment.

"Metrovick" fluorescent lighting for cigarette manufacture

Fuel Statistics

The 1950 "Statistical Digest" of the Ministry of Fuel and Power is now available from H.M. Stationery Office (price 15s). It comprises 165 tables (217 pages) relating to the coal, electricity supply, gas and oil industries. The electricity section contains 33 tables covering in detail such matters as numbers and capacities of power stations; boiler plant; energy generated and sold; works costs; station efficiencies; fuel used; numbers employed; capital expenditure; sales and revenue; classes of consumer; and analyses by Divisions of the B.E.A. and Areas. Although the statistics are in a convenient form, in many cases later information is contained in the third annual report of the British Electricity Authority.

Accident Prevention Exhibition

An exhibition for the promotion of accident prevention and safety for workers recently held at the Derby locomotive works was the first of its kind ever held on British Railways (London Midland Region). The main theme was to help workers eliminate the risk of many of the accidents which occur in large engineering works. Exhibits were divided into sections dealing

with the works medical and accident service, workshop exhibits, fire prevention, electrical hazards, the protection of eyes, and respiratory safeguards.

There were in addition sections largely comprising exhibits from industrial firms specializing in machine guarding and in safety footwear, and by the Safety and Welfare Museum, Horseferry Road, London. The exhibition was opened by Mr. J. F. Harrison, London Midland mechanical and electrical engineer.

Peak Load Competition

The Electrical Association for Women, as part of its contribution towards the peak economy campaign, organized a competition among its branches, for which nearly 100 entries were received. Two prizes of two guineas each were offered for the best hint for economizing in the use of electricity in the household during (*a*) the morning peak, 8 a.m. to noon, and (*b*) the evening peak, 4 to 5.30 p.m. A third prize was awarded for general hints applicable to either peak, as so many entries were received in this category.

Showroom Lighting

When Dormeuil Frères, a West End firm of woollen merchants, decided to provide a new showroom at their Warwick Street premises they were faced with the problem of exhibiting some thousands of cloth patterns in the limited space at their disposal and they devised an arrangement of hinged frames carrying samples of cloth on each side. These frames are mounted vertically in two sections in a specially formed recess some 20ft long, the whole resembling two extended "books" standing on end with the "bindings" against the wall. Customers are thus able to examine a wide range of classified patterns simply by turning the "pages" of the book. The lighting problem was to provide shadow-free illumination of a completely uniform intensity on every frame and this has been accomplished by the use of one row of "Sieray" 5ft 80 W fluorescent lamps behind a shallow canopy at the front edge of the frames.

The showroom also has a display stage where dual purpose lighting is provided. This is in the form of separately controlled "Sieray" colour matching blue fluorescent lamps and warm white fluorescent lamps above an ornamental metal grille over the stage. A specially constructed cornice accommodates a continuous row of 5ft 80 W fluorescent lamps with overlapped ends to provide the general lighting for the showroom. The lighting was designed by the Illuminating Engineering Department of Siemens Electric Lamps & Supplies, Ltd., and installed by Druce & Co., Ltd., Baker Street, London, W.1.

"Sieray" lighting at the new London showroom of Dormeuil Frères

Overseas Competition

In the course of a speech at a meeting of the Birmingham Branch of the Institute of Export recently Mr. D. Maxwell Buist, export director of the British Electrical and Allied Manufacturers' Association, commented on the competition with which British exporters were faced. He said that the Americans were active in all Great Britain's traditional overseas markets. Japanese competition was growing tremendously. Lately Japanese prices had not been low, they were often higher than our own, but they were succeeding by giving earlier delivery. Germany, too, was returning as a strong competitor; her exports during the first ten months of the year were "fantastic."

Mr. Buist said that the obvious way of meeting this competition was longer working hours in this country. He also thought that the direction of labour might be essential.

Price Maintenance in Canada

The Canadian Electrical Manufacturers' Association recently told a Canadian House of Commons special committee on retail price-fixing that the practice whereby a manufacturer established the price at which his product

would be sold to the public tended to prevent peaks and valleys in the whole economic structure. It eliminated "lay-offs" and stabilized employment. It was not true, the Association said, that price maintenance discouraged economic efficiency, as maintained by the MacQuarrie Committee which recommended steps against resale price maintenance.

Radio Research

The report of the Radio Research Board together with that of the Director of Radio Research has just been published for the Department of Scientific and Industrial Research by H.M. Stationery Office, price 1s 9d (45 cents U.S.A.), by post 1s 10½d. This 51-page publication contains details of the work carried out on problems concerning radio propagation through the upper and lower atmosphere, direction finding, navigational aids and radio noise. Among other investigations undertaken were studies of the electrical properties of germanium and of measuring techniques at very high frequencies.

Export Prospects

Speaking at the Christmas dinner of the Institute of Export last week, Mr. H. L. d'A. Hopkinson, Secretary for Overseas Trade, referred to the necessity for cutting imports and raising exports. He said that while the defence programme bore most hardly upon the engineering industries, it was for the products of these industries that the best export possibilities existed. It should be possible to increase exports of metal goods and the Government would give the utmost practical backing to manufacturers and exporters.

The president of the Institute, Mr. Leslie Gamage (G.E.C.), said that exports from this country had reached a level which was not dreamed of a few years ago. It was doubtful whether they could go much higher. He thought that the adverse trade balance was due to the high prices paid for imports, not to lack of exports.

Death from Infra-Red Lamp

A verdict of "Death by misadventure" was returned at an inquest at Radcliffe, Lancs, on 17th December on Patrick Joseph Barron, a farm labourer. As reported in the *Manchester Guardian*, the evidence showed that Barron was found by his wife in the piggery of a farm at Whitefield on 29th November clutching an infra-red ray lamp which was still burning.

Dr. G. B. Manning, a Home Office pathologist, said that death was due to electric shock. Barron's employer, Mr. James Sherlock, said that he had purchased the lamp, with flex, holder and adaptor, on the afternoon of the accident. He had told the supplier that he wanted the lamp for his piggery but nothing was said about getting a qualified electrician to install it.

Mr. E. Chapman, an electrician, of Rochdale Road, Manchester, said that Sherlock asked him to "make the leads up." He was unable to fix the lead himself because he could not find the piggery and so he handed the lamp and fittings to Barron. He had not tested the lamp and it did not occur to him that it was dangerous.

The deputy-coroner said that it was essential that the supplier should advise buyers of such lamps to have them installed by qualified electricians.

Informing the Staff

With the view to keeping staff and workpeople as much as possible in the picture and giving them early information of all items of interest a wall news sheet has recently been issued for display in the works, offices and branch offices throughout the Lancashire Dynamo organization. It is hoped also that by this means an interest will be created internally as to the different individual activities of the various companies which now form the Lancashire Dynamo group. The scheme is being run initially for a period of six months and constructive criticism is being sought during that time so that the value of the scheme may be assessed. Large printed cards permit the display of four sheets of news at one time. These sheets are changed periodically to introduce new subject matter.

"Mechanical World" Year Book

The *Mechanical World* Year Book for 1952, which is available from Emmott & Co., Ltd., 31, King Street, Manchester, 3, price 3s 6d, has been revised and extended and in its 360 pages there are a number of new features. There is now a section on inventions and patents and patenting procedure. Apart from tables and data there are also sections on such varied topics as engineering productivity, gas turbines, plastics, fuel and lubricating oils, machine tools, steam boilers and die-casting.

Water Heating Code

Domestic electric water heating installations are the subject of CP327.202 (1951) which has now been issued in its final form by the Council for Codes of Practice for Buildings as part of the series on the provision of household electrical equipment and apparatus.

It deals with the design of domestic hot-water systems, whether they rely solely on electric heaters, or use electric heaters in conjunction with fuel-fired boilers, great emphasis being laid throughout on the importance of heat conservation and on the proper relative positioning of the various components of hot-water systems using electricity. Advice is given on the necessary consultation at the planning stage and on the choice of materials, appliances and components.

Recommendations are given on the design of

various types of system, on desirable water temperatures, and on volumes of stored hot water. Sections on inspection and testing and on maintenance are included. Appendices give useful information on factors affecting heat loss and water flow, and on dimensions of water-heaters. Diagrams show typical layouts of water-heating systems using electricity and a method of fitting an immersion heater to a tank.

Copies may be obtained from the British Standards Institution, 24-28, Victoria Street, London, S.W.1, price 3s, post free.

Research in Aeronautics

A new research fellowship, valued at £500 a year, for the study of advanced problems involved in aeronautical engineering and design, has been established by the English Electric Co., Ltd., at the University of Glasgow. Under the supervision of Professor W. J. Duncan, F.R.S., Mechan Professor of Aeronautics and Fluid Mechanics in the University of Glasgow, holders of the new fellowship carry out investigations into problems of the vibration, stability and control of aircraft. Appointments will be made by a board constituted by Glasgow University and the first holder will be selected early in 1952.

Export Inquiry

A New Zealand firm of manufacturers of motor-car accessories asks British manufacturers for quotations for battery equipment including analysers, chargers, hydrometers, terminal pullers, carriers and cable.

Brass Cased Steel Tubing

Manufacturers of lighting fittings will no doubt be interested in the German-made brass cased steel tubing, which is available from Walter Logan & Co., Ltd., 26, Downing Court, Brunswick Square, London, W.C.1, as the price compares favourably with that of solid brass tubing and delivery is prompt. It is made by drawing a thin brass casing over the inner steel tube, which protrudes to allow threads to be cut on the steel. Tubes of $\frac{3}{8}$in, $\frac{1}{2}$in and $\frac{5}{8}$in diameter can be supplied in any lengths above 20in, either with threads on both ends (26 t.p.i.) or on one end only.

Trade Announcements

The Manchester office of **Bruce Peebles & Co., Ltd.**, Edinburgh, is now at 26, Corporation Street, Manchester, 4 (telephone : Deansgate 7105). The Edinburgh works of the company will be closed for the New Year holiday from 31st December to 4th January.

The Lamp Advertising Department of the **British Thomson-Houston Co., Ltd.**, is removing to London this week and the address is now 18, Bedford Square, W.C.1 (telephone : Langham 7056).

The Midland area sales office of **Tufnol, Ltd.**, is now at Cornwall Buildings, 45, Newhall Street, Birmingham, 3. The telephone number remains unchanged.

The London sales office and warehouse of the rubber and plastic cables division of **Standard Telephones & Cables, Ltd.**, have been transferred to 48, North Row, Mayfair, W.1 (telephone : Mayfair 4392).

Change of Address

The Institute of Packaging has removed to 20–21, Took's Court, Cursitor Street, London, E.C.4 (telephone: Chancery 8484).

Catalogues and Lists

Londex, Ltd., Anerley Works, 207, Anerley Road, London, S.E.20.—Technical data book describing the company's range of relays, timers and other automatic control apparatus.

English Electric Co., Ltd., Switchgear Department, East Lancashire Road, Liverpool, 10.—Spare parts list for medium voltage air-break switchgear type OB3.

Richard Johnson & Nephew, Ltd., Forge Lane, Manchester, 11.—Comprehensive technical booklet containing tables and data on the company's entire range of ferrous and non-ferrous wires.

Superlamp, Ltd., 24a, St. Giles High Street, London, W.C.2. — Comprehensive priced and illustrated catalogue of electrical accessories, appliances, tools, instruments and lighting equipment.

Best & Lloyd, Ltd., Wattville Road, Handsworth, Birmingham, 21.—Catalogue of lighting fittings for hospital, school and domestic use.

Courtney, Pope (Electrical), Ltd., Amhurst Park Works, Tottenham, London, N.15.—Illustrated folder on industrial and shop-window fluorescent lighting fittings.

W. T. Henley's Telegraph Works Co., Ltd., 51-53, Hatton Garden, London, E.C.1.—Catalogue of distribution pillars and panels.

J. Day & Co. (Derby Works), Ltd., Harrow Manor Way, Abbey Wood, London, S.E.2.—Display card containing samples of the range of "Davu" radio wires, television cables, etc.

High Duty Alloys, Ltd., Slough, Bucks.—Illustrated booklet on aluminium forgings.

Renold & Coventry Chain Co., Ltd., Renold Works, Didsbury, Manchester, 20.—Illustrated brochure on chain toggle clutches.

Cooke & Ferguson, Ltd., Victoria Street, Manchester, 11.—Technical folder on the type OD2 outdoor oil circuit breaker.

MANUFACTURING PROGRESS—1951

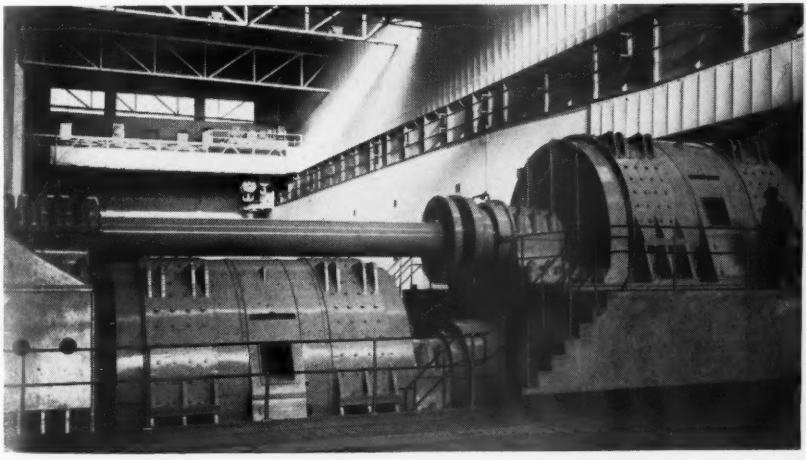
English Electric Co., Ltd.

IN the electricity supply field probably generating plant—steam turbine, water turbine and diesel-engine sets—took front place in this company's activities in the past year. The largest set commissioned is the 60 MW unit at Fulham which will ultimately have steam operating conditions of 900 lb/sq in and 900 deg F. Also commissioned were the first two of the four 50 MW sets at the Bromborough (Birkenhead) power station, and two further 30 MW sets at Llynfi now bring the two automatic unit sister stations in line regarding generating capacity. Among other orders for the home market, are a 100 MW turbo-alternator for Willington, with steaming conditions of 1,500 lb/sq in and 1,050 deg F; two 60 MW sets for Drakelow (1,500 lb/sq in, 1,050 deg F); and three 60 MW sets for Wakefield (900 lb/sq in and 900 deg F). Important overseas orders include a fourth 60/66 MW set for the J. Clark Keith power station of the Hydro-Electric Power Commission of Ontario.

In the hydro-electric field the fourth 32·5 MW set for Loch Sloy (North of Scotland Hydro-Electric Board) was nearing completion and two 22 MW sets were commissioned at the Fasnakyle station of the same Board. Sets commissioned abroad include those at Cofrentes, Spain (40 MW) and Tekapo, New Zealand (25 MW). Joint contracts placed with the English Electric Export & Trading Co. and the Metropolitan-Vickers Electrical Export Co. resulted in the commissioning of two 45 MW sets for Castelo do Bode in Portugal. It is believed that the order for a 106,500 kVA generator for the Kemano power station of the Aluminium Co. of Canada represents the largest generator to be manufactured by a British company.

Activities in connection with diesel plant were also brisk, the orders including three 16-cylinder pressure-charged alternator sets for Accra University and thirty-three 12-cylinder pressure-charged engines and generators for the New Zealand Government Railways. There was considerable development in connection with the company's dual-fuel engines. Two to

This 27,600 h.p. (peak) slabbing mill drive is believed to be the first twin mill drive in the British steel industry and the largest reversing drive in the country



operate on sewage gas and fuel oil were commissioned for the Coventry Corporation, and contracts also included five 8-cylinder engines to run on methane gas and drive alternators at the N.C.B. Point of Ayr Colliery.

Technically, public supply transformer developments have been stimulated by the forthcoming 275 kV grid and in this connection there are orders for two 120 MVA 275/132 kV three-phase auto-transformers with on-load tap-changing equipment for installation at Drakelow. In the export field an outstanding development relates to four 100 MVA 110 kV three-phase double-unit booster transformers with on-load tap-changing gear for Tasmania.

The switchgear shops were also busy on public supply and other work. In the oil-break field a good deal went to the B.E.A., including two complete 66 kV outdoor substations for the Yorkshire Division. As regards air-blast equipment, orders were received for three 132 kV substations—two for the B.E.A. and one for the North of Scotland Board. Much air-break switchgear for power station auxiliaries was installed at the new Wigan, Skelton Grange, Bromborough, Nechells "B" and Blackwall Point power stations.

In the industrial sphere much of the company's activity has related to the very extensive steelworks programme at home, and in this connection we consider that pride of place is taken by the drive of the new slabbing mill at the Abbey Works of the Steel Company of Wales, Ltd., Port Talbot. This is believed to be the first twin mill drive in the British steel industry and the largest reversing drive in Britain. The peak rating is 27,600 h.p., the speed is 40/80 r.p.m. and the maximum torque is 3·6 million lb/ft. A close second is probably the drive for a 46in blooming and slabbing mill of the South African Iron and Steel Corporation. It is a double-armature drive with a normal rating of 7,300 h.p. at 54/120 r.p.m.

The major rectifier applications were to main steel-mill drives. These include two equipments rated at 6,000 kW 550 V and 2,500 kW 540 V ordered to augment the d.c. output of motor generators feeding hot strip mills in a large steelworks. The first of four 10,000 A 325 V equipments for the electrolytic refining of copper or zinc in Northern Rhodesia was commissioned during the year.

Among the important mining developments are those represented by orders for a complete 1,725 h.p. winder and a 1,03 h.p. haulage for the National Coal Board The winder will have a bi-cylindro-conical drum driven through a single reductio gear, and both the winder and the haulag will be provided with d.c. dynamic braking

Textile industry electrical development are also well in the limelight, an importan example being the complete electrificatio of John Bright's Moss Mill, Rochdale where a total of 2,000 h.p. of individua driving motors will be installed.

A new 25 kW h.f. induction heater ha been engineered as a production tool and facilities are available to enable applicators, work handling gear or jigs to be mounted directly on the equipment. The heater uses a single air-blast cooled oscillator valve to eliminate maintenance troubles inherent in water cooled valves. The rectifier has single anode mercury pool type valves which are grid controlled for both power control and voltage stabilization.

In the domestic appliances field a new model refrigerator (76A) was introduced. It has a food compartment of 7·6 cu ft volume, with a shelf area of 14·6 sq ft.

Management Publications

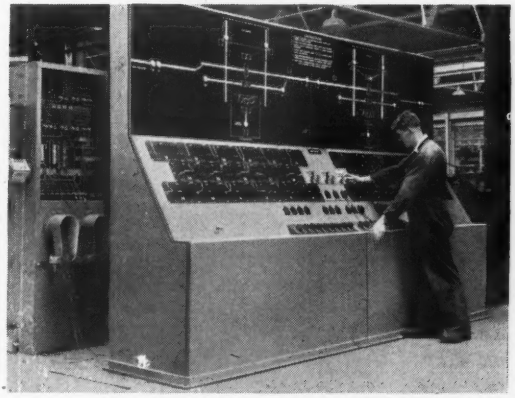
TWO new publications have been issued by the British Institute of Management, Management House, 8, Hill Street, London, W.1. "Job Evaluation—A Practical Guide" (price 7s 6d, or 6s to members and subscribers, post free) has been prepared by a panel under the chairmanship of Mr. J. J. Gracie, C.B.E., general manager, General Electric Co., Ltd., Witton. The authors maintain that the complexities and anomalies of wage scales both in industry as a whole and in a single factory can be reduced by systematic job evaluation. The four main systems of job evaluation are described, the problems of introducing a system are discussed, and there is an explanation of the stages of job evaluation. In the appendices several examples of existing schemes are given.

"Drawing Office Organization" (price 5s, or 4s to members and subscribers, post free) is a revised edition of Part 9 of B.S.1100 Services, Office Aids to the Factory. Originally written for firms engaged on armament production, the material can be adapted to others with very little change.

The Institute has sent us a copy of the address which the Earl of Verulam delivered at the recent B.I.M. autumn conference on "The British Responsibility in Management."

Special-purpose Switchgear

Equipment for Coal Mines and Oil Refineries



Sequence control panel for power station conveyor equipment with "Perspex" diagram illuminated to indicate when selected routes come into operation

BESIDES designing and producing electric switch and control gear for general industry, M. & C. Switchgear, Ltd., specializes in electrical equipment for the coal mining and oil industries. Its well-equipped Kelvinside Works at Kirkintilloch, nr. Glasgow, now has 50,000 sq ft of production area and employs upwards of 400 employees.

The parent company, Mavor & Coulson, Ltd., claims to have designed and manufactured in 1894 the first ironclad completely enclosed electric motor. In 1885 it established the first electric power station in Scotland supplying high voltage a.c. This electricity supply business was ultimately taken over by the city in the early 'nineties and was the nucleus from which the Glasgow Electricity Department evolved. Another pioneering achievement of note was the first demonstration in Europe of three-phase ship propulsion by the vessel *Electric Arc* built in 1910.

Although the parent company concentrated mainly on the manufacture of coal-cutting and conveying equipment after the first world war, the Switchgear Section continued to expand and in 1931 it was decided to form a separate organization with the title M. & C. Switchgear, Ltd.

Present-day products at Kelvinside Works, Kirkintilloch, include oil-break switchgear up to 3,000 A at 660 V and 400 A at 3,300 V. A range of medium voltage oil-immersed circuit breakers up to 1,600 A is also manufactured and covered by A.S.T.A. certificates of rupturing capacity. All these circuit breakers are designed for individual mounting or for building into switchboards in either unit or cubicle assemblies. A standard range of a.c.

Putting the finishing touches to a coal preparation plant starter board

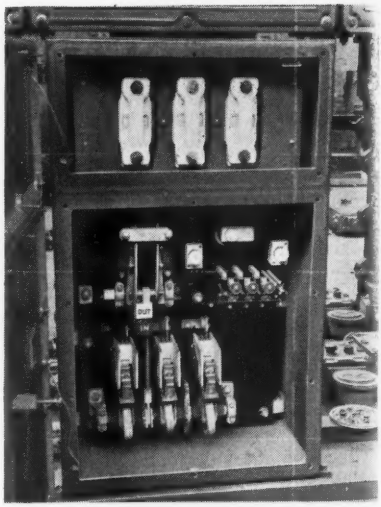
starters extends up to 450 h.p. at 660 V and to 250 h.p. at 3,300 V. All intermediate ratings of these items are available and at the extreme end of the range is a 5 h.p. 660 V contactor starter with incorporated triple-pole isolator. Enclosures to suit particular conditions are available in totally enclosed, hoseproof, flameproof and tropical patterns.

A varied range of accessories such as push-button switches is also manufactured which can be supplied in single- and multi-point assemblies, with indicating lamps if required; enclosures can be provided for service in normal industrial conditions or in inflammable atmospheres.

Certified flameproof switch and control gear for coal face machinery are also produced for use with coal-cutters, conveyors, drills and haulages; accessories include bell-ringing and lighting transformers, plugs and sockets, and couplers, sequence switches and relays.

A specially interesting item nearing completion when we visited the factory recently was a control panel for a complicated coal handling equipment at a power station. The numerous conveyors are represented on the panel by a " Perspex " diagram which illuminates to indicate the selected conveyor routes when they are put in operation by means of plugs and push-button switches on the control panel.

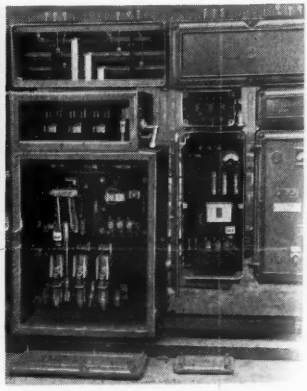
Another item to which the finishing touches were being applied was a group motor control board with direct-on starters up to 30 h.p. and oil-immersed circuit breakers. Those controlling the alternative sources of incoming supply are mechanically interlocked. This board is for service at a coke oven plant and will control the entire installation.

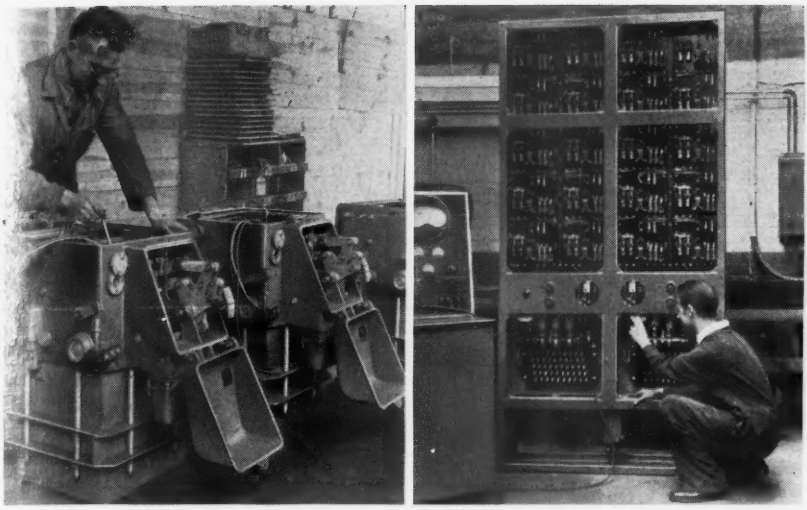


Direct-on starter forming part of a board for an East Indies oil refinery

The demand for all classes of equipment for the oil industry has developed enormously since the end of the war and the company has provided group motor starter boards for oilfields and refineries in

Left: **Group control starter board for installation at an East Indies oil refinery.** *Right:* **Section of group control motor starter board for a British refinery**





Left: **Assembling 1,600 A 660 V draw-out heavy industrial type oil-immersed circuit breakers.**
Right: **Testing a power distribution panel for service at a British airport**

all parts of the world. Starter boards for this class of service are built on the unit principle and can easily be extended or rearranged. Extensive use is made of light alloy enclosures for weight saving purposes and for durability in the tropics.

A feature of the starter units is the design of the triple-pole thermal overcurrent relay which embodies a compensating arrangement for wide variations in ambient temperature. The various units are isolated from the busbars by either triple-pole withdrawable h.r.c. fuses or a triple-pole isolating switch, depending on the requirements of the appropriate authorities. During our tour of the assembly bay a starter board for a home refinery and another for a refinery in the East Indies were nearing completion.

Airport Equipment

An interesting item on test was one of a batch of distribution panels for a British airport. The incoming supply to each panel is split between two 75 A t.p. and n. contactors each with earth leakage relay and indicator and stop/start push-buttons. There are twenty circuits each controlled by a double-pole contactor; the outgoing cables are led to the runways and hangars where flameproof push-button switches control the various circuits. Each push-button unit incorporates a 30 A flame-proof restrained and interlocked plug and socket to take the outgoing cable.

NEXT WEEK'S EVENTS

Wednesday, 2nd January

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "The Protection of Electrical Power Systems—A Critical Review of Present Day Practice and Recent Progress," by H. Leyburn and C. H. W. Lackey.

Thursday, 3rd January

LONDON.—At the Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 6 p.m. Institution of Engineering Inspection. "Quantity Production of Geared Instruments for Time and Linear Measurements," by T. G. Mercer.

NOTTINGHAM.—E.M.E.B., Smithy Row,5 .30 p.m. I.E.S. Nottingham Centre. "The Lighting of Modern Ocean Liners," by T. Catten.

Friday, 4th January

BATH.—S.W.E.B. Lecture Theatre, Old Bridge, 7 p.m. I.E.S. Bath and Bristol Centre. "Neon Lighting," by C. Higgins.

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.S. Birmingham Centre. "Modern Transport Lighting," by W. E. J. Drake.

Saturday, 5th January

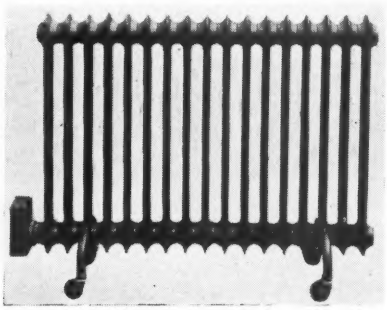
BIRMINGHAM.—Grand Hotel, 3 p.m. Birmingham Electric Club. Children's party.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Space Heaters

OIL-FILLED electrically heated and thermostatically controlled space heaters are now being manufactured by STEEL RADIATORS, LTD., Stelrad Works, Southall, in wall, standard and mobile types. Loaded at 1 kW, the heater has a consumption of approximately $\frac{3}{4}$ kWh per hour.



Mobile type space heater

Two pilot lights indicate whether the unit is using electricity and also whether it is connected directly to the supply, thereby avoiding waste. The apparatus is constructed of steel and stove enamelled in gold-bronze and cream. The retail price of the wall and standard types is £14 14s 4d (plus £11 0s 9d P.T. in the United Kingdom). The mobile type costs 2 gns more (including 18s P.T.).

Illuminated Artificial Flowers

A range of lighted fireproof plastic flowers from normal size up to large groups as used for the Blackpool illuminations, advertising displays on building fronts, etc., has been developed by A. J. MILLER, 53, Wilton Place, Knightsbridge, London, S.W.1.

Signal Lamp Fitting

The "Rafi" single hole fixing signal lamp fitting offered by LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20, is designed to accommodate a 15 W small Edison screw lamp and is fitted with a thick glass lens which can be either red, green, blue or clear. The fitting can be used with a panel up to 1in thick, the bulb can be changed from the front of the panel and the terminals are shielded.

Left: **Londex signal lamp fitting for s.e.s. lamps**

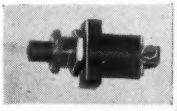
Automatic Door Switch

Though designed primarily for refrigerators, wardrobes, etc., an automatic door switch (S.230) made by ARCOLECTRIC (SWITCHES), LTD., Central Avenue, West Molesey, is also suitable for use as a courtesy light switch in cars, and for certain other general applications as a limit switch. The switch is rated 1 A, 250 V and is designed for fixing in a single $\frac{1}{4}$in hole. It is biased normally "on," a very small depression of the push breaks the circuit and the rest of the movement of the push is "over-run."

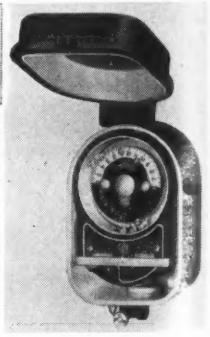
The simplicity of the design (slow make and break) ensures that the switch will have a very long life. All current carrying parts are heavily silver plated. The price is 3s.

Reserve-Spring Time Switch

An electrically wound time switch with spring reserve which is claimed to be the smallest of its type on the market is available from the HORSTMANN GEAR CO., LTD., New Bridge Works, Bath. Known as the type "Y," it has been designed to meet all requirements of public lighting control. The movement is fitted in a dustproof case but the complete time switch is also available in a weatherproof box measuring only 6$\frac{1}{2}$in high by 3$\frac{3}{4}$in wide by 3$\frac{5}{16}$in deep. For the standard model with hand set dial either two or four tappets can be supplied, and when the switch is fitted with a solar dial intermediate tappets are available.



Arcolectric automatic door switch



Right: **Horstmann time switch with reserve spring**

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

S. Smith & Sons (England), Ltd., held their annual meeting on 19th December, Mr. A. Gordon-Smith (chairman and managing director) presiding. In the course of his speech, the chairman said that the group turnover had been considerably increased during the year under review, and all the main divisions of their business had contributed. In referring to the activities of their divisional companies, the chairman said that Smiths English Clocks, Ltd., had maintained their position as one of the largest combined clock and watch manufacturing concerns. Their "Sectric" clocks were well maintaining their leadership in the electric clock field and continued to enjoy an expanding world sale. The Kelvin & Hughes group had considerably increased its marine, aviation and industrial business. A new echo sounder especially designed for small boats fishing in shallow waters, and also a new type of navigation radar were introduced last year.

Aberdare Cables Africa, Ltd.—The annual meeting was held on 7th December at Port Elizabeth, Sir George Usher (chairman) presiding. In his circulated statement, the chairman said that a high rate of production was achieved during the year under review, despite the increasing difficulties in regard to the supply of raw materials. The South African Bureau of Standards had recently issued specifications for paper insulated cables for general purposes and for heavy duty, and their company had been authorized to use the SABS mark on cables manufactured to these specifications. Referring to the widening of their range of products, the chairman said that there would shortly be installed in the factory plant for the production of p.v.c. insulated cables.

Telephone Rentals, Ltd., has declared an interim dividend of 4 per cent. This is at the same rate as last year, but is paid on capital increased by a 10 per cent scrip bonus.

Solus Teoranta (the Irish lamp-making concern) is paying an unchanged interim dividend of 5 per cent.

Murex, Ltd., has declared an interim dividend of 6 per cent (against 5 per cent).

The **Oriental Telephone & Electric Co., Ltd.,** is paying an interim dividend of 4 per cent (unchanged).

Waygood-Otis, Ltd., are again paying an interim dividend of 30 per cent.

New Companies

Coliseum Electrical Engineering Co., Ltd.—Registered 15th December. Capital £2,000. Electrical, radio, television and mechanical engineers and contractors, etc. Directors: W. H. Jones and Mrs. Alice Jones. Secretary: J. A. Jones. Regd. office: 398, Manchester Road, Bradford.

Cable Improvements, Ltd.—Registered 8th December. Capital £1,000. To acquire and use patent rights, brevets d'invention, concessions, etc; to carry on the business of manufacturers of and dealers in electrical appliances, engineering products, radio, radar and television equipment, cables, appliances and materials used in connection therewith, etc. B. Zucker is chairman and managing director. Secretary: George Williams. Regd. office: 21, Panton Street, S.W.1.

Bankruptcies

W. R. Eagle, lately carrying on business at 10, Houghton Chambers, 1, Houghton Place, Liverpool, electrical contractor.—Receiving order made 29th October on a creditor's petition.

H. Busfield, residing and formerly carrying on business at 6, Wilfield Street, Burnley, as an electrical engineer.—First and final dividend of 3¾d in the £, payable at 20, Byrom Street, Manchester.

R. L. Foggin, lately carrying on business as "Tithebarn Radio Co.", at 63, Tithebarn Street, Liverpool, and as "Crosby Radio Co.", at 75, Crosby Road North, Waterloo, Lancs., and as "High Bridge Radio Co.," High Bridge, Newcastle-on-Tyne, electrical engineer.—Supplemental dividend of 2s 6d in the £, payable at the Official Receiver's office, West Africa House, 25, Water Street, Liverpool, 2.

Liquidations

Clyde Electric Installations (Manchester), Ltd.—Winding up voluntarily. Liquidator, Mr. W. F. Riding, 1, Cooper Street, Manchester, 2.

Palace Electrical Co., Ltd.—(In voluntary liquidation). Meetings of members and creditors on 18th January, at Walter House, 418-422, Strand, London, W.C.2, to receive an account of the winding up by the joint liquidators Messrs. M. S. Josephs and A. W. Hunter.

STOCKS and SHARES

IT may be said without any fear of possible contradiction that the coming New Year will start, looking at it from the Stock Exchange point of view, from a more favourable platform of prices than that which prevailed at the beginning of 1951. Prices in the gilt-edged market have suffered a heavy fall, lowering them to a level which, a year ago, would have seemed difficult to visualize, particularly in view of the fact that a Conservative majority was to result from the General Election. The process of deflation has been, and continues to be, a painful one. The only people who benefit from the lower prices are those who have money to invest and are now able to buy considerably more stock with the same amount of money. Stock Exchange activity has been spasmodic during the year; investment has shown strong predilection for equity shares, and these have held their ground better than the gilt-edged group has done.

Gilt-Edged Stocks

Throughout the year, the gilt-edged market has had the worst of two worlds. For the greater part of it, the pressure of inflation was hustling money out of fixed-interest bearing securities into equities, which appeared to offer better protection, both for capital and income, against the persistently falling value of money. When a new Government pledged to reverse that process took power, it assumed the almost forgotten weapons of dearer money and tighter credit as a principal means to the end. Following the raising of Bank Rate, and supplementary measures, Government securities had perforce to adjust themselves to an altogether higher yield basis. As a result, prices took in November one of the most drastic plunges that people can remember. A slender recovery late in the year leaves the whole list, nevertheless, with serious net depreciation over the twelve months. Of the British Electricity Board issues, the $3\frac{1}{2}$ per cent stock has fallen from 103 to $88\frac{5}{8}$; the 3 per cent stock 1968–73 from $96\frac{3}{4}$ to $83\frac{3}{4}$; and the 3 per cent stock 1974–77 from $96\frac{1}{4}$ to $82\frac{3}{4}$.

Industrial Markets

Unlike gilt-edged stocks, industrial shares had matters much their own way for at least some part of the past year. They ran into heavy weather towards the end of it, but many shares retain useful appreciation, on balance, for the second year in succession. Inflation was responsible for part of the early popularity of equities; it probably had a good deal to do with the impressive showing made in the majority of the annual reports and accounts published by companies during the period. Matters were assisted by the fact that, after the long dividend freeze, many firms permitted themselves a little more liberality in the matter of distributing increased earnings. The surprise of the year was, of course, the anti-climax to the change of Government, with its immediate sequel of deflationary measures and higher interest rates which brought prices tumbling down in the train of the gilt-edged market. In the year's closing stages, industrials are finishing with a fairly confident, although still chastened, air.

Electrical Equipment Shares

Securities in the market for electrical equipment shares have kept their place, through all the year's ups and downs, among the most favoured industrials. Many of the big manufacturers have paid better dividends from appreciably higher profits. In conformity with the general experience, the post-election relapse spoilt the picture, and left the list with the irregular appearance shown by the following comparisons:—

Company	End December 1950	End December 1951	Change
	s. d.	s. d.	s. d.
Associated Elec. Ind. ..	85 0	85 0	—
Crabtree Electrical ..	39 0	34 6	− 4 6
Crompton Parkinson ..	11 6	10 0	− 1 6
Elec. Construction ..	61 3	57 6	− 3 9
English Electric ..	47 6	58 9	+11 3
G.E.C.	82 0	91 6	+ 9 6
Lancashire Dynamo ..	96 3	43 9 (ex-bonus)	− 8 9
Reyrolle	76 3	43 0 (ex-bonus)	+ 9 9

These changes, and those in the following table, allow for capital bonuses, but not for "rights" issues.

Cables and Telephones

Shares of the principal cable manufacturers have been comparatively subdued during most of the year under the impression that raw material costs and shortages were proving particularly difficult in this industry. They have held their ground moderately well, however, and the telephone group has had another good year:—

Company	End December 1950	End December 1951	Change
	s. d.	s. d.	s. d.
Automatic Telephone ..	62 0	67 6	+ 5 6
British Insulated Calender's	33 6	31 0	− 2 6
Enfield Cable	32 0	27 6	− 4 6
Henley's	23 6	21 0	− 2 6
Johnson & Phillips ..	62 0	56 3	− 5 9
Siemens	31 3	39 6	+ 8 3
Telegraph Construction	42 6	38 9	− 3 9
Telephone Manufacturing	10 6	9 0	− 1 6

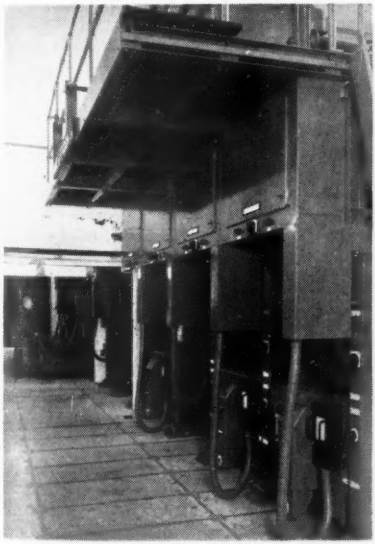
ELECTRICITY SUPPLY

Folkestone Grid Substation

Generating Station in Aldershot District?

GROWING demands for electricity at Folkestone, Dover and Ashford have caused extensions to the Folkestone grid substation to be carried out by the South Eastern Division, S.E.A. The grid supplies to Folkestone were originally given through two 15 MVA 132/6·3 kV transformers. In addition, supplies were also given from this point to Dover and Ashford at 33 kV through 6·6/33 kV transformers. The reinforcement has been achieved by installing two 30 MVA 132/33 kV transformers to which the Dover and Ashford loads have been transferred, thereby leaving the original 132/6·3 kV transformers to carry the Folkestone load only.

The new transformers (Brush) have been banked in pairs on the 132 kV side with the existing transformers, the connections in one case being by overhead conductors and in the other by 132 kV oil-filled cables (Henley's).



Interior of switch house at the Folkestone grid substation

The 33 kV switchgear is Cooke & Ferguson's type FTE5, heavy metalclad, single break, phase-segregated, duplicate busbar, vertically isolated equipment, arranged for off-load bus transfer.

No Assistance for South West

The British Electricity Authority has informed the South Western Electricity Consultative Council that there is no hope of a scheme of financial assistance being introduced as suggested by the Council. The chairman (Alderman H. J. Parry) reported this to the Council at its recent meeting at Exeter. The Council had pointed out to the Authority that because of the sparse population and lack of industry in the Area special financial assistance was needed to enable the Board to provide the fullest possible rural supplies on reasonable terms.

At the same meeting, Mr. S. F. Steward, chairman of the Board, said that the Board's new tariff system had been designed to cover costs and leave a margin. They hoped to hold the tariff at its present level but the position was bound to be dominated by the continued rise in costs.

Power Station Site

The Thames Conservancy Land Drainage Committee reports that the British Electricity Authority has under consideration the possibility of constructing a new generating station in the Aldershot–Farnborough district, and that the choice of a site will be influenced by the availability of water for cooling purposes. In this connection the Authority proposes to construct a gauging station on the River Blackwater to measure the flow at North Camp, Farnborough.

Pumping Stations and Power Cuts

Having received a letter from the North Western Electricity Board saying that pumping stations could not be exempted from power cuts, the borough surveyor of Blackpool drew attention to the serious consequences which might result if it were to rain during a time when the pumping stations were without power. Discussions subsequently took place with the Board's representatives and it was agreed that power should be restored to the stations on request.

Queensland's Power Needs

Importance of Adequate Expansion

IN a letter presenting the fourteenth annual report of the Queensland Electricity Commission to the Minister of Mines and Immigration, the Commissioner for Electricity (Mr. H. Neil Smith) emphasizes that electrical expansion is fundamental to the industrial development and closer settlement of the State. Moreover, defence requirements call for a sufficient margin of plant capacity.

As in other countries, serious difficulties are being encountered because of shortages of materials. The position with regard to steel and copper is now worse than it has ever been, and the Commissioner fears that unless a speedy solution is found it may bring the development programme to a standstill. So far, the greatest hold-up seems to be in constructional work rather than imported plant for, strangely enough, at the time that the report was written there were actually three 30,000 kW turbo-alternators lying in store in Brisbane which could not be erected until further progress had been made in building construction. Every endeavour has been made to secure steel, fabricated and unfabricated, from Australian sources and overseas, but the situation has become steadily worse.

To the problem of supply is added that of cost, and this is reflected in the figure of nearly £30 million for works in hand or scheduled to be started in the current financial year. During 1950 expenditure amounted to £3,932,535; this year it is expected to reach £9,739,390.

The review of generating facilities begins with South-Eastern Queensland, supplied by the Brisbane City Council, the City Electric Light Co., Ltd., and the Toowoomba Electric Light & Power Co., Ltd. Allowing for suburban railway electrification, possible defence needs and a somewhat greater normal increase in load, it is anticipated that the demand may rise within the next ten years from 167,000 kW to 466,000 kW. The first new sets at Bulimba "B" and Tennyson stations, which were expected to be in operation in 1952 and 1953, respectively, are likely to take a year longer. To meet the situation 10,000 kW "packaged" power stations were ordered by the Brisbane Council and the City Electric Light Co., but the report is not sanguine that these will be in operation by the middle of 1952 as promised.

The Regional Electricity Boards are next dealt with. Power stations are in course of erection at Howard, Rockhampton and Townsville, each designed for an ultimate installed capacity of 52,500 kW, while the Tully Falls project is being developed to provide a supply for the whole of the Cairns Region.

To accelerate transmission line construction a comprehensive specification was prepared for all Regions and a contract has been let for 920 miles costing £1,362,865 and planned to be completed in about three years. Rural development is encouraged by Government subsidies, those paid in 1949–50 amounting to £226,824.

	1948–49	1949–50
Electricity sold, mill. kWh* ..	601·0	664·3
Pop. of area served	864,812	865,602
No. of consumers	230,587	243,161
Av. consumption, kWh. ..	2,606	2,732
Total revenue	£4·1 mill.	£4·9 mill.
Revenue/kWh sold	1·65d	1·772d
Cost/kWh sold	1·513d	1·733d

*Includes electricity resold to other authorities.

Detailed statistics are published for generation and distribution in the State, as shown in the accompanying table. Of the total sales in the year ended 30th June, 1950, those by private authorities aggregated 322·2 million kWh; by public authorities, 228·0 million; and Regional Electricity Boards, 114·1 million.

In the part of the report dealing with inspection it is noted that in spite of the increase in the number of consumers there has been a downward trend in fatal accidents. There were five of these during the year. Two could have been prevented if the electrical work had been carried out by qualified electricians. One unfortunate occurrence, the first of its kind in Queensland, was brought about by a breakdown at a pole transformer point. As a result a girl received a fatal shock when the frame of the iron she was using was made "alive."

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) will be obtainable after 6th February from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1946

33823. Dallenbach, W.—Apparatus for accelerating electrically charged particles. 14th November, 1946. (Cognate application 33824, 15th February, 1946.) (666202.)

1947

14202. Standard Telephones & Cables, Ltd., and Reeves, A. H.—Electric discharge tubes. 28th May, 1948. (665982.)

15860. Marconi's Wireless Telegraph Co., Ltd., and Ramsay, J. F.—Radio-wave lenses. 1st July, 1948. (666203.)

20698. Petel, L. L. L.—Lighting fitting combined with loudspeaker. 30th July, 1947. (Cognate application 20699, 11th July, 1947.) (666204.)

21700. Sylvania Electric Products, Inc.—Method and apparatus for threading a wire leading from one member into an aperture in another member. 7th August, 1947. (666205.)

30316. Telefonaktiebolaget L. M. Ericsson.—Gaseous discharge tubes. 14th November, 1947. (666123.)

1948

1434. Lysholm, A.—Gas turbine power plant. 16th January, 1948. (Cognate application 1435, 28th February, 1947.) (666062.)

3037. Niles-Bement-Pond Co.—Electromagnetic gauge. 2nd February, 1948. (666127.)

15726. Goodwin, C. P.—Protective apparatus for use by operators of electric cutting and welding equipment. 10th June, 1949. (666219.)

18495 and 21771. Western Electric Co., Inc.—Electron-discharge apparatus. 9th July and 18th August, 1948. (666221 and 666224.)

22187. General Electric Co., Ltd., and Ollerenshaw, C.—Electrical waveform shaping circuits. 19th August, 1949. (665913.)

22641. Standard Telephones & Cables, Ltd., and Rogers, D. C.—Electron-discharge devices. 26th August, 1949. (Cognate application 31352, 3rd December, 1948.) (666229.)

23621. Standard Telephones & Cables, Ltd., Starr, A. T., Lewin, L., King, G., and Shatford, P. A.—Linear accelerators for charged particles. 8th September, 1948. (665998.)

24876. Belling & Lee, Ltd., and Bryce, N. D.—Aerials. 19th April, 1949. (665999.)

25007. Standard Telephones & Cables, Ltd., Clark, R. L., and Holland, J. D.—Receiving arrangements for teleprinter signals. 24th September, 1948. (666231.)

25624. Plessey Co., Ltd., Cleave, E. S., and Trowbridge, D. R.—Cordite operated starter turbine. 29th September, 1949. (665916.)

25865. O'Shei, W. E.—Suction motors. 8th October, 1949. (666069.)

27737. Nielsen Co., H. C.—Search signal apparatus for determining the listening habits of wave-signal receiver users. 25th October, 1948. (Cognate applications 27738, 24th October, 1947, and 27739, 24th October, 1947.) (666070.)

28355. American Electro Metal Corporation.—Compressor blade for use in gas-turbine and turbo-jet power-plant. 1st November, 1948. (666135.)

28672. Standard Telephones & Cables, Ltd., and Beck, A. H. W.—Electric discharge devices. 28th October, 1949. (666000.)

30396. Concordia Electric Safety Lamp Co., Ltd., and Cornish, J. P.—Battery cases. 9th November, 1949. (666241.)

1949

306. Bolt, R. R.—Electrically heated upholstery. 5th January, 1949. (666245.)

1239. British Driver-Harris Co., Ltd., and Marsh, W. F.—Alloys particularly for resistance wire for electric fires, heaters and the like. 7th February, 1950. (666071.)

1624. Tyler & Co., Ltd., H., and Ivanoff, V.—Fluid-sealing devices for electrical conductors. 13th January, 1950. (666142.)

2045. General Electric Co., Ltd., Osborne, W. C., and Rycroft, J. L.—Electric air-heating units. 9th February, 1950. (666072.)

3083. Electric & Musical Industries, Ltd.—Voltage stabilizers. 18th January, 1950. (666251.)

3186. Siemens Bros & Co., Ltd.—Electro-magnetic counting mechanisms. 3rd February, 1950. (666253.)

4102. Standard Telephones & Cables, Ltd., and Foulkes, C. H.—Electron-discharge devices. 15th February, 1949. (666152.)

4417. Miller & Co., Ltd., H., and Meadows, W.—Dynamos. 20th March, 1950. (666261.)

4798. Leitz Ges., E.—Arrangements for producing optical images by phase-contrast methods. 22nd February, 1949. (665923.)

5218. Dehn, S. G. (General Cement Mfg. Co.).—Wire stripper. 25th February, 1949. (666264.)

5389. British Thomson-Houston Co., Ltd.—Ultra-high-frequency electromagnetic radiation heating apparatus. 28th February, 1949. (666074.)

5557. Pyrotenax, Ltd.—End seals for electric cables. 31st January, 1950. (666157.)

6135. Antiference, Ltd., and Best, N. M.—Support for a rigid aerial. 26th January, 1950. (666266.)

6176. Radio Corporation of America.—Optical systems and colour selective reflectors for use therein. 7th March, 1949. (666160.)

6228. Electric & Musical Industries, Ltd.—Transmitting or receiving aerial systems for centimetre wavelengths. 20th February, 1950. (666267.)

7022. Ferranti, Ltd., and Williamson, D.—Systems for operating a small two-phase motor from a single-phase supply. 13th March, 1950. (666268.)

7595. Decca Record Co., Ltd., and Bridges, D. E.—Thermionic valve circuits for resetting a relay at a predetermined period of time after the initial operation thereof. 21st March, 1950. (666162.)

7796. Parsons & Co., Ltd., C. A., and Backhouse, L. S.—Optical systems applicable to spectrometers. 7th March, 1950. (666270.)

8155. Standard Telephones & Cables, Ltd., and Stephens, C. J.—Electric variable-frequency oscillation generators. 25th March, 1949. (665924.)

8769. Plessey Co., Ltd.—Electromagnetic lenses. 16th March, 1950. (666168.)

8818. Tecalemit Soc. Anon.—Electrical arrangement for the detection of deformation suitable for use on vehicles. 31st March, 1949. (Cognate application 8819, 21st July, 1948.) (666169.)

9308. Marconi's Wireless Telegraph Co., Ltd., Beanland, C. P., and Cybulski, K.—Automatic frequency control system. 29th November, 1949. (665925.)

10483. Radio Corporation of America.—Voltage regulator circuits for direct voltage. 20th April, 1949. (666078.)

12177. **M-O Valve Co., Ltd., and Le Rossignol, R.**—Directly heated cathodes for thermionic valves. 8th May, 1950. (666175.)

12178. Antiference, Ltd., and Best, N. M.—Wireless aerial. 23rd February, 1950. (666285.)

12184. Siemens Electric Lamps & Supplies, Ltd., Ward, N., and Austin, F.—Fittings for electric lamps. 5th May, 1950. (666286.)

12761. Kennedy, A., and Owen, R.—Insulator for aerials. 9th May, 1950. (666085.)

13336. Electric & Musical Industries, Ltd.—Television transmission systems. 5th May, 1950. (666289.)

13399. Black & Decker Manufacturing Co.—Electromagnetic strain gauge. 19th May, 1949. (665936.)

14154. General Electric Co., Ltd., and Jackson, P. J.—Apparatus for generating electrical oscillations and for providing automatic frequency control of those oscillations. 17th May, 1950. (666088.)

14463. General Electric Co., Ltd., Bridges, D. H., and Macara, J. S.—Systems for changing the frequency of electrical oscillations. 30th May, 1950. (666178.)

14692. Western Electric Co., Inc.—Filters for guided electromagnetic waves. 1st June, 1949. (666294.)

14952. Morle, C. W. (Magnavox Co.).—Primary electric cells. 3rd June, 1949. (666005.)

15285. Philips Electrical, Ltd.—Photographic flash lamps. 8th June, 1949. (666182.)

17277. Automatic Telephone & Electric Co., Ltd.—Electrical signalling systems. 14th June, 1950. (666008.)

17436. Westinghouse Electric International Co.—Electric motor control systems. 1st July, 1949. (666191.)

17509. Decca Record Co., Ltd., and Powell, C.—Radio navigation systems. 3rd July, 1950. (666010.)

17904. Soc. Anon. de Telecommunications.—Harmonic generators. 6th July, 1949. (666012.)

18150. British Insulated Callender's Cables, Ltd.—Electric couplings and other electrical apparatus comprising a metal casing in which an insulating body is moulded. 7th July, 1950. (Cognate application 11933, 12th May, 1948.) (666014.)

18328. Veaux, H. M.—Telephone and like transmission systems and transmitters and receivers for use therein. 11th July, 1949. (666301.)

18388. General Electric Co., Ltd., and Forbes, W. A.—Telephone systems. 19th May, 1950. (666017.)

18601. Plessey Co., Ltd.—Radio-frequency power amplifiers. 14th July, 1950. (666019.)

18607. Radio Corporation of America.—Apparatus particularly for tuning radio receivers and transmitters, 14th July, 1949. (666020.)

19635. British Thomson-Houston Co., Ltd., and Wood, C. W.—Lampholders for double-ended electric lamps. 26th May, 1950. (666097.)

19834. Crabtree & Co., Ltd., J. A., and Morgan, R. W.—Shielded electric sockets. 27th July, 1950. (666098.)

19994. Western Electric Co., Inc.—Electron-discharge devices. 29th July, 1949. (666099.)

20263. Dinley, C. F.—Control systems for electric motors, driving centrifuges, and the like. 3rd August, 1949. (665941.)

21005. Thomson, C. L.—Photo-electric meters. 14th August, 1950. (665942.)

21048. British Thomson-Houston Co., Ltd.—Electric induction apparatus. 12th August, 1949. (666033.)

21807. Reffin, G., and Walker, T. F.—Electromagnetics. 18th August, 1950. (666037.)

22702. British Thomson-Houston Co., Ltd.—High-frequency dielectric heating apparatus. 1st September, 1949. (666044.)

22760. Anderson, J. M.—Electric frying stoves. 31st July, 1950. (666045.)

22960. Carr Fastener Co., Ltd.—Mounting strips and electrical wiring tags for mounting thereon. 27th July, 1950. (666048.)

23036. Fleischmann, E., and Fleischmann, J. (trading as Fleischmann, Geb.).—Points for electric toy railways. 6th September, 1949. (666049.)

23374. **Philips Electrical, Ltd.**—Thermionic cath[illegible]es. 9th September, 1949. (666053.)

24162. **Westinghouse Electric International C[illegible]**—Electronic control systems for direct current ele[illegible]ric motors. 20th September, 1949. (666056.)

24424. **Electric & Musical Industries, Ltd.**—Tools [illegible]or stripping coverings from the ends of covered ca[illegible]s, conductors and the like. 13th September, 1950. (666[illegible])

24801. **Wayne Kerr Laboratories, Ltd., and Calver[illegible]t.**—Automatic frequency control circuits. 27th Decem[illegible]r, 1950. (666103.)

27088. **Standard Telephones & Cables, Ltd., Jacol[illegible]n, B. B., and Daly, C. T.**—Automatic gain control arra[illegible]e-ments for carrier-current communication systems. [illegible]st October, 1949. (665951.) 27089. Fault locating arra[illegible]e-ments for electric carrier-current communication syste[illegible]s. (665952.)

27111. **Huwyler, A.**—Arrangement for regulating [illegible]e speed of asynchronous three-phase motors. 21st Octol[illegible]r, 1949. (665953.)

27718. **Akt.-Ges. Brown, Boveri & Cie.**—Cooled [illegible]as turbine rotor. 28th October, 1949. (665956.)

29268. **Anderson, Boyes & Co., Ltd.**—Earth leak[illegible]e protective systems for use with polyphase a.c. dynam[illegible]-electric machines and other apparatus. 27th Septembe[illegible]r, 1950. (665964.)

29342. **General Electric Co., Ltd., and Dale, S. H.**—Electric motor control systems. 9th November, 1950. (665965.)

29762. **Boston, D. W.**—Thermionic amplifiers. 21st November, 1949. (665967.)

31605. **Victor Products (Wallsend), Ltd., and Wiles, R. C.**—Electrical plug-and-socket connectors. 17th August, 1950. (665972.)

31688. **British Thomson-Houston Co., Ltd., and Maggs, A. H.**—Control systems for direct current motors. 17th November, 1950. (665973.)

32834. **King, D. M.**—Pull-cord operated devices particularly electric switches. 8th November, 1950. (665978.)

32912. **Shepherd, G. H.**—Chemical protection of economizers for steam generators. 23rd December, 1949. (665979.)

32925. **Standard Telephones & Cables, Ltd.**—Clutching mechanism for crossbar switches. 23rd December, 1949. (665980.)

Amended Specifications

638823. O'Brien, W. J.—Thermionic valve amplifiers.

639603. Dunlop Rubber Co., Ltd., & Others.—Snap-action electric switches.

Lighting of Road Vehicles

INFORMATION of value to all owners and users of motor vehicles, particularly operators of goods and passenger carrying types, is given in a memorandum (RVL, August, 1951) which has been issued by the Ministry of Transport (H.M. Stationery Office, price 3d) in replacement of the memorandum No. 276 (Roads) of 1937. It briefly sets out in a convenient form the provisions of the Acts and Regulations now in force relating to the lighting of road vehicles, excepting tramcars and trolley-buses, which operate under special Acts, including certain amendments which have been made to conform with changes in the law during the past fourteen years. The latter are the reasons for publication of the new memorandum now; it does not imply any relaxation of the efforts being made to resolve the twin problems of driving lamp dazzle and rear light improvement.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—BRISBANE.—25th January. Brisbane City Council. Supply of medium and low voltage airbreak switchgear for Tennyson power house, Tender T13/51. (C.R.E. (I.B.) 78210/51. Ten/3384.)*

Belfast.—18th January. City Electricity Department. Sluice valves and penstocks for Victoria power station. (See this issue.)

India. — 23rd January. Government of Travancore-Cochin. Supply of outdoor cut-outs. (C.R.E. (I.B.) 78222/51. Ten/3379.)* 19th January. Supply of 300 11 kV switches. (C.R.E. (I.B.) 78221/51. Ten/3381.)*

London.—POPLAR.—8th January. Borough Council. Supply of electric lamps for one year. Town clerk, Town Hall, Bow Road, E.3.

Morpeth.—Town Council. Electrical installations in 56 houses in Spelvit Lane. F. K. Perkins, borough engineer, 36, Bridge Street.

Newhaven.—31st December. U.D.C. Installation of electricity to 58 Council houses. Surveyor, Council Offices, Fort Road.

Pakistan.—KARACHI.—2nd January. Government Department of Supply and Development. Supply of two 379 kVA current limiting reactors. (C.R.E. (I.B.) 77727/51. Ten/3369.)*

Preston.—7th January. Lancashire County Council. Street lighting. (See this issue.)

South Africa.—PRETORIA.—24th January. General Post Office. Supply of 11,000 lightning protectors. (C.R.E (I.B.) 77905/51. Ten/3373.)*

Southern Rhodesia. — SALISBURY. — 11th January. Electricity Supply Commission. Supply of 168 miles of steel cored aluminium conductors and accessories. (C.R.E. (I.B.) 77883/51. Ten/3371.)*

Uganda. — 11th February. Uganda Electricity Board. Owen Falls hydro-electric power station. (See this issue.)

Wrexham.—31st December. Borough Council. Electrical installations in 110 dwellings now in course of erection. Borough surveyor, 31, Chester Street.

ORDERS PLACED

Durham.—County Education Committee. Electrical work at schools, etc.:—Horden Colliery County and Horden Girls' Modern Schools (£6,016).—Robson & Coleman, Ltd. Spennymoor Alderman Wraith Secondary Modern School (£5,052).—North of England Engineering & Electrical Co., Ltd.

Manchester.—Corporation Highways Committee. Accepted. Stores for the year ending 31st December, 1952:—Wire and cable for street lighting.—Edison Swan Electric Co., Metropolitan-Vickers Electrical Co., British Driver Harris Co. and Crompton Parkinson. Electrically wound single-pole time switches.—Venner.

Newcastle-on-Tyne. — Regional Hospital Board. Alterations to electrical system at Newcastle General Hospital (£1,985).—Veale Nixon, Ltd. Electrical installation in nurses' home at Hexham General Hospital (£1,869).—Falconar Cross & Co., Ltd.

Peterborough.—Corporation. Recommended. Electrical installations in shops, flats and branch library on Dogsthorpe/Newark estate (£1,496).—Johnson Pearce & Co., Ltd.

Southport.—Education Committee. Recommended. Electrical equipment and fittings for Technical College extensions (£4,910).—Robert Springer, Ltd.

Estates Committee. Recommended. Installation of electricity in 182 houses on the Essex Road estate (£3,881).—Brooks & Southworth.

Swansea.—Housing Committee. Electrical installations in 115 houses on the Penlan site (£2,629).—D. A. Fisher.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Adwick (Yorks).—Houses (70). Carcroft, and shopping centre on new Woodlands housing estate; U.D.C. architect, Council Offices.

Alston.—Houses, Grisedale Lane; Graham & Roy, architects, Paternoster Row, Carlisle.

Ammanford.—Houses (64) and 12 flats, Bishop Road estate; M. R. Gethin, surveyor, Council Offices, College Street.

Baildon.—Shops, houses, flat and garages, Knoll estate; W. Illingworth & Son, architects to U.D.C., 15, Sunbridge Road, Bradford.

Basildon.—Works: Bonallack & Sons, Ltd., Nursery Lane, Forest Gate, E.7.

Bath.—Laboratory extensions, etc., Domestic Science Training College; Snailum, Huggins & le Fevre, architects, 18, Brock Street, Bath.

Birkenhead.—Works extensions; Norman Foods, Ltd., Canning Street.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

Bolton.—Dwellings (71), Adrian site; housing director.

Bootle.—Houses for Borough Council: City Contractors, Ltd., 40 North John Street, Liverpool (18) and S. Byrom (Formby), Ltd., Formby (32).

Broadstairs.—Infants' school, Grange Road; W. R. H. Gardner, architect, 8, Cecil Square, Margate.

Burnley.—St. Hilda's R.C. Secondary School, Cherry Fold (£120,607); Wimpenny & Co., Ltd., builders, Prestwich, Manchester.

Cardiff.—Works extensions; British Ropes, Ltd., Western Avenue.

Primary school, Bwlch Road; P. Jeans & Co., Ltd., builders, 71, Moorland Road.

Cheltenham.—Flats (204), Arle and Hesters Way estate; Louis de Soissons & Partners, architects, 3, Park Square Mews, N.W.1.

Chertsey.—Kitchens, dining rooms etc., at St. Peter's Hospital; E. H. Vincent, architect, 76, Wimpole Street, W.1.

Chesterfield.—Flats at rear of Newbold House; borough surveyor and architect, Council Offices.

Cleator Moor.—R.C. secondary modern school (£99,639) for Cumberland E.C.; P. A. Baines & Son, builders, Culgaith.

Clevedon.—Coleridge Vale Junior and Infants' School; R. O. Harris, architect, Park Street, Taunton.

Cwmbran.—Project for development of new town; Minoprio & Spenceley, architects, 18, Seymour Street, Portman Square, London, W.1.

Derby.—Factory for Foister Clay & Ward, Ltd.; F. Garner & Sons, Belgrave Road, Leicester.

Pathological laboratory at Derbyshire Royal Infirmary for Sheffield Regional Hospital Board; Ford & Weston, Ltd., Osmaston Road, Derby.

Harwich.—Dwellings (124), as first part of Pound Farm housing scheme, Dovercourt; borough architect, King's Quay Street.

Heanor.—Houses (22), Hardy Crescent site, and 52 at Marlpool Farm estate; U.D.C. surveyor.

Hertford.—Public hall, Horns Mill; Howes & Jackman, architects, 1, Verulam Buildings, Gray's Inn, W.C.1.

Hinckley (Leics).—Bus station between Lancaster Road and Rugby Road; U.D.C. architect.

Houses at Burgage (26), Barwell (46) and Earl Shilton (28); U.D.C. architect.

Leeds.—Seacroft West C.P. School; city architect.

Littleborough.—Houses (14) at Wallbank; C. Taylor & Son (Bacup), Ltd.

Liverpool.—First part of community centre at Speke estate; Unit Construction Co., Ltd., Liverpool.

London.—Holborn.—Nurses' home at St. Paul's Hospital, Endell Street; W. S. Try, Ltd., builders, High Street, Cowley, Uxbridge.

Poplar.—Maisonnettes and flats (258), Teviot Street; Percy Bilton, Ltd., contractors, 113, Park Street, W.1.

Putney.—Maisonnettes (296), houses (56) and aged persons' dwellings (18), Putney Vale estate, for Wandsworth B.C.; Arthur W. Kenyon, architect, 15, Adeline Place, W.C.1.

Luton.—Houses (340), Bambridge estate; borough surveyor.

Margate.—Flats (32) and houses (87), Crow Hill Road site; borough surveyor.

Newcastle-on-Tyne.—Generating house, Lucozade factory, Vickers Lane; R. H. Husband, 49, Boston Park Road, Brentford, Middlesex.

Newcastle (Staffs).—Houses for Borough Council: Cornes Construction Co., Ltd., Station Road, Tunstall (98 dwellings); A. Jones, Ltd., London Road, Chesterton (23); and Roberts Bros., 204, High Street, Hanley (12).

Peterborough.—Hostel for old people, Thorpe Road (£28,800); architect, Soke of Peterborough C.C., Town Hall, Peterborough.

Rotherham.—Shops and workrooms, 25/27, High Street; Willsons (London & Provinces), Ltd., 46, Edgware Road, W.2.

Factory, Bawtry Road; British Oxygen Co., Ltd., 24, Grafton Street, W.1.

Salford.—Flats (66), Islington Street; Unit Construction Co., Ltd., Knutsford, Cheshire.

Scunthorpe.—Canteen for Grammar School (£7,635); Lindsey county architect, Lincoln.

Sedgley.—Houses at Firs and Quarries sites; U.D.C. surveyor.

Smethwick.—Neurosurgical unit at Isolation Hospital (£86,275), A. F. R. Godfrey & Co., Ltd., 10, Clifton Street, Wolverhampton.

Sowerby Bridge.—Houses (24), Kershaw House estate, for U.D.C.; Wm. Parker & Sons, Ltd., Sowerby Bridge.

Stockport.—Three-storey buildings with shops on ground floor, Binnington estate; W. Dobson Chapman, architect, Macclesfield.

Stretford.—Flats: Stretford Road (18); Chester Road (6), and St. Hilda's Church site (16), and 10 houses at Warwick Road South and King's Road; borough surveyor.

Swansea.—Showrooms and offices, High Street, for A. G. Meek; Griffith Davies & Co., Ltd., builders, Paxton Yard.

Tottington.—Houses for Rigg Bros., Ltd.; Leach, Rhodes & Walker, architects, 90, Deansgate, Manchester.

Watford.—Showrooms, shops and restaurant, High Street and Upton Road; Montague Burton, Ltd., Hudson Road Mills, Leeds.

Factory premises; British Drug Houses, Ltd., Graham Street, N.1.

West Bromwich.—Gravity and pressure die casting premises; Sandwell Castings Co., Ltd., Bank Street.

Widnes.—Stage 1 of college of further education, and first section of Ditchfield Road County Primary School; borough architect, Brendan House, Widnes Road.

ELECTRICAL REVIEW

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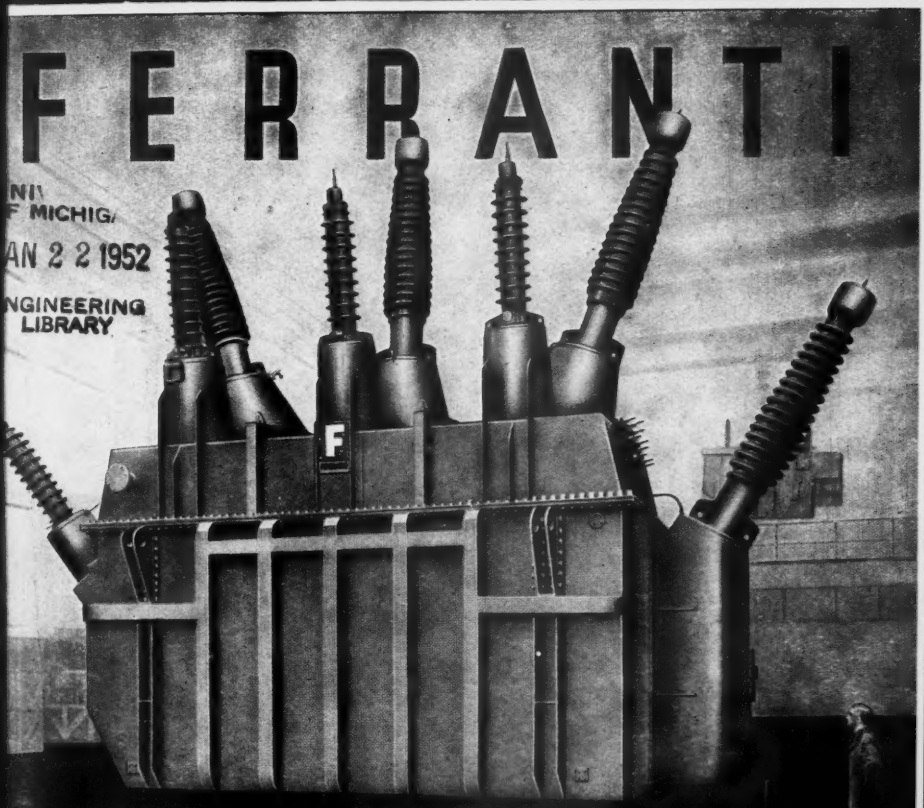

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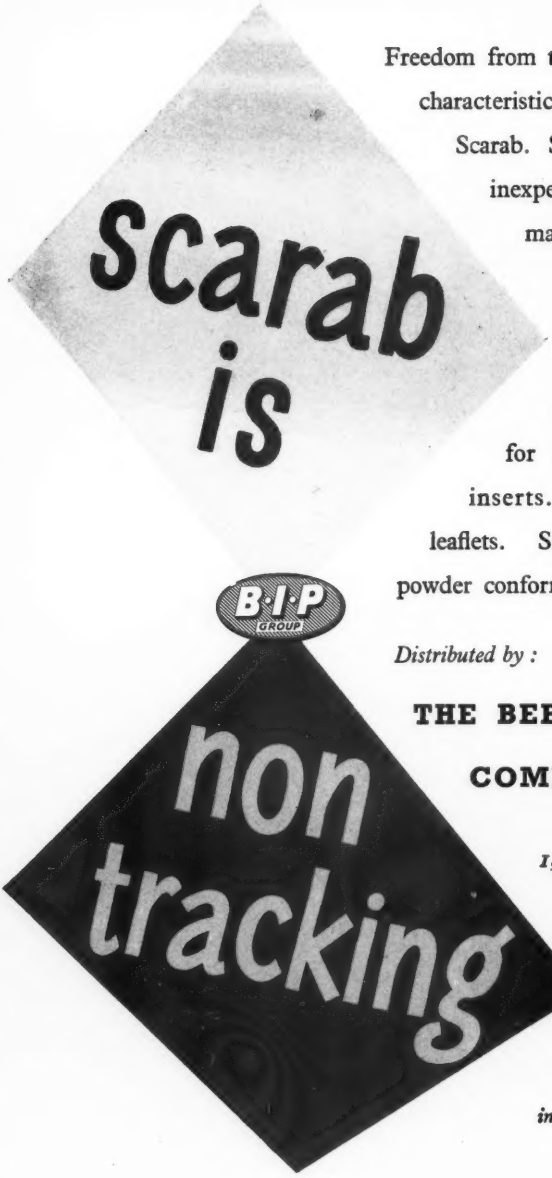

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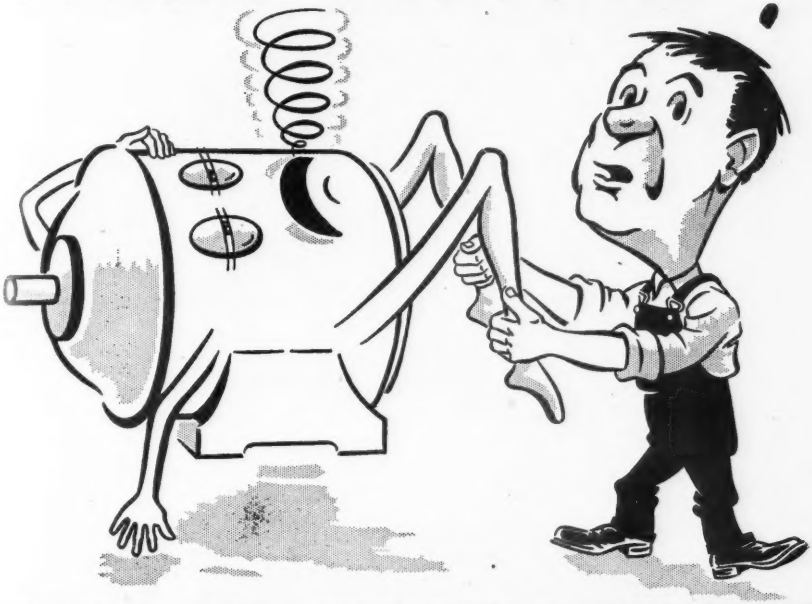
TIRED MOTORS ?



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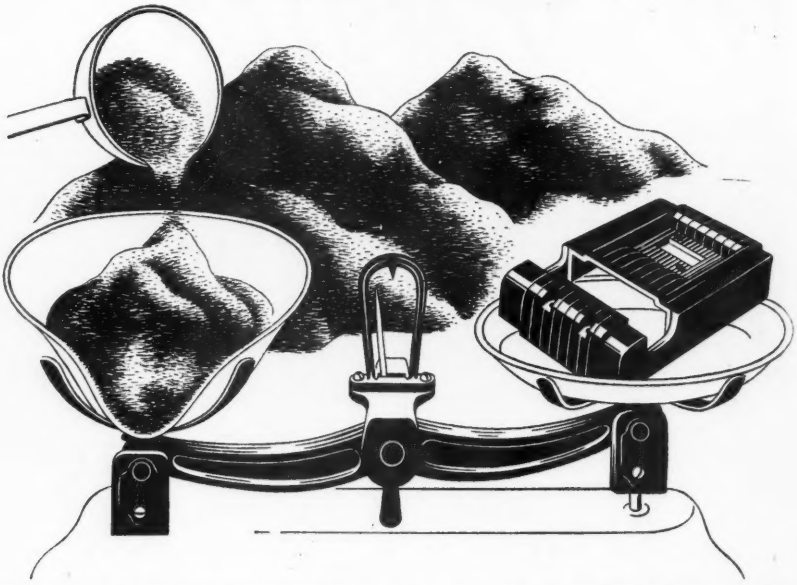
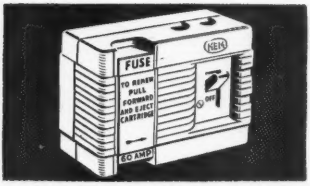


HOW MUCH BAKING POWDER TO A SWITCH-FUSE?

The men on the presses moulding plastic components at the MEM works can tell you the exact amount of 'baking' powder needed for each component. Plastic moulding is one of many trades which flourish at the MEM factory. Ironfounding, diecasting, porcelain making, are some of the others which go to make MEM a *self* contained factory. MEM make it better by making every part themselves. And incidentally it costs less too.



The Mem-ac switch-fuse brings you giant performance with dwarf dimensions.

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Switch, fuse and motor control gear, electric fires and localised lighting equipment

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Branches in London and Manchester.

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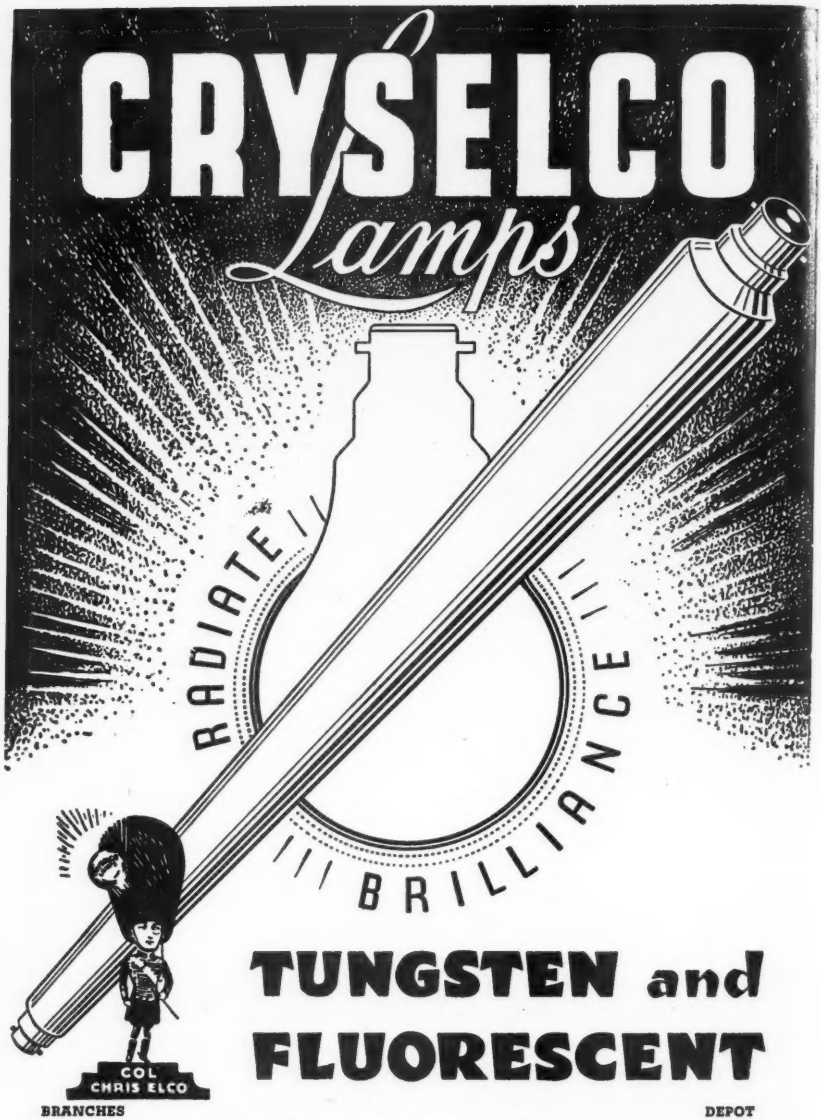

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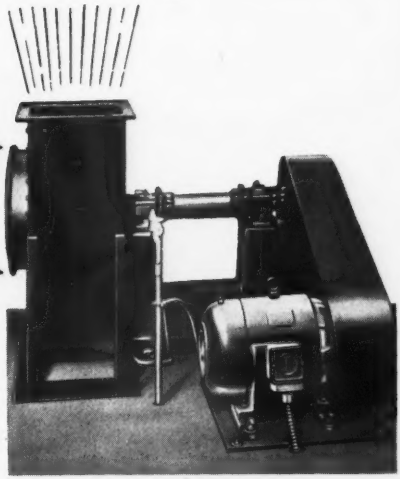

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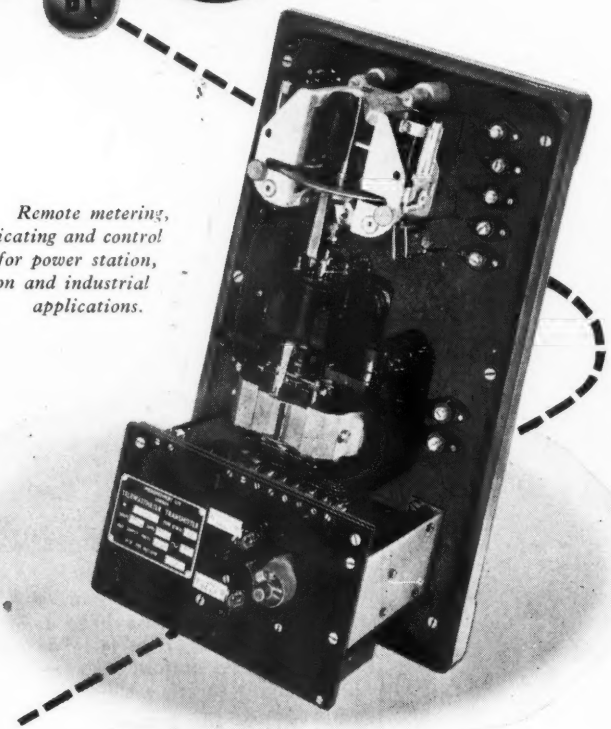
Remote metering, indicating and control for power station, sub-station and industrial applications.



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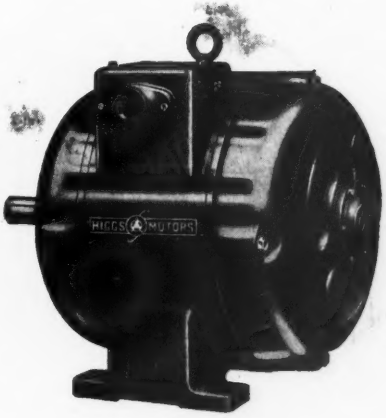

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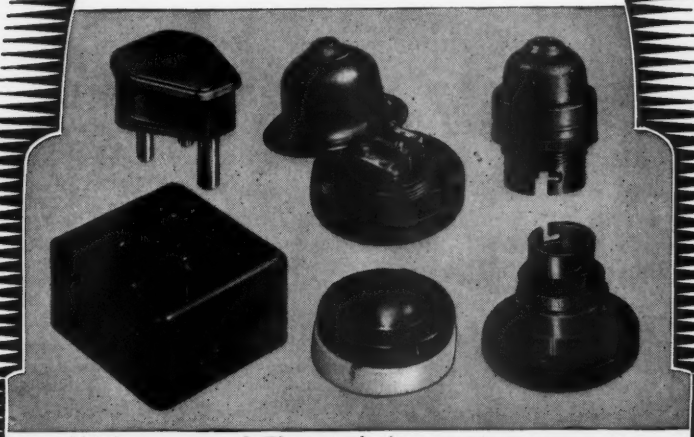

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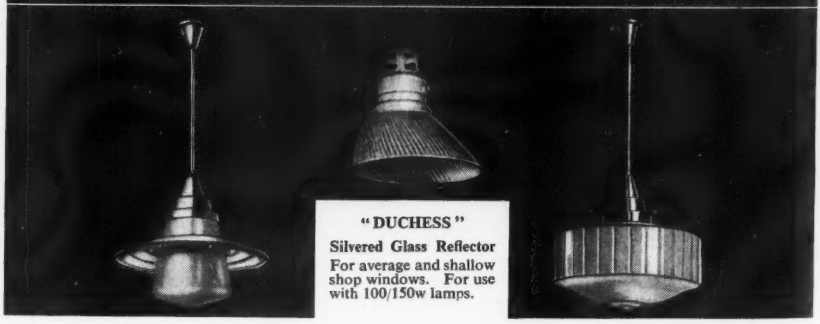

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GROUP 24

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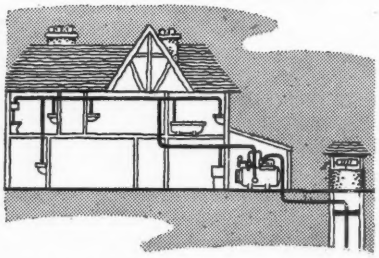
The perfect

WATER SYSTEM

for the country home...



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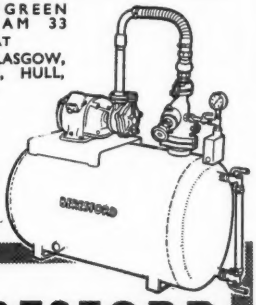

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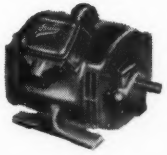

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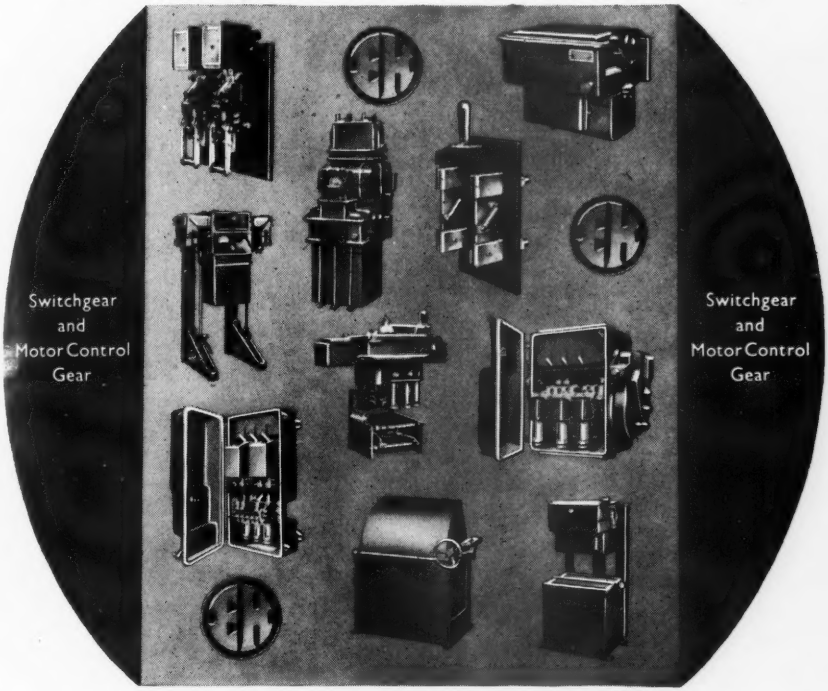

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SWITCHGEAR 50 Amps. up to 5,000 Amps.

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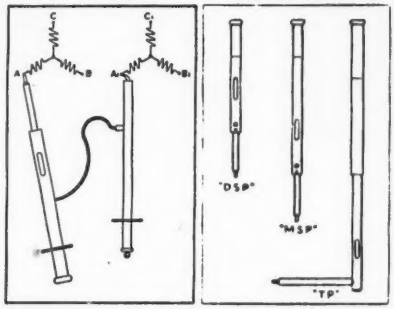

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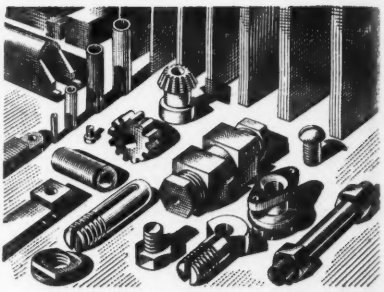

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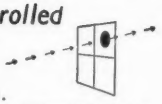

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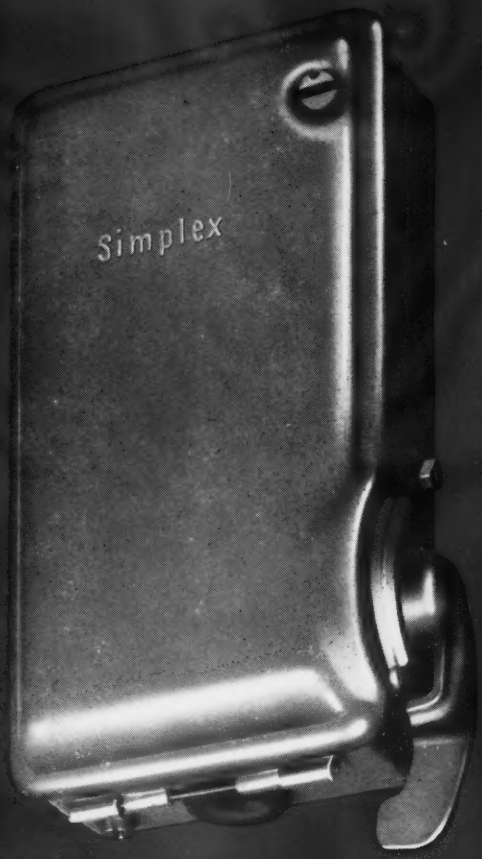

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15 AMP 250 VOLT

SWITCH FUSE

CATALOGUE NO 3481

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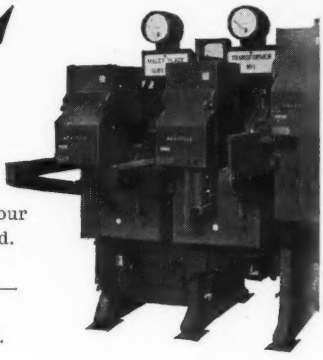

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METALCLAD SWITCHGEAR

CRC 185

"This world famous bronze" said the Managing Director waving an arm 'is a lesson and a model for you all—Watts' 'Energy'."

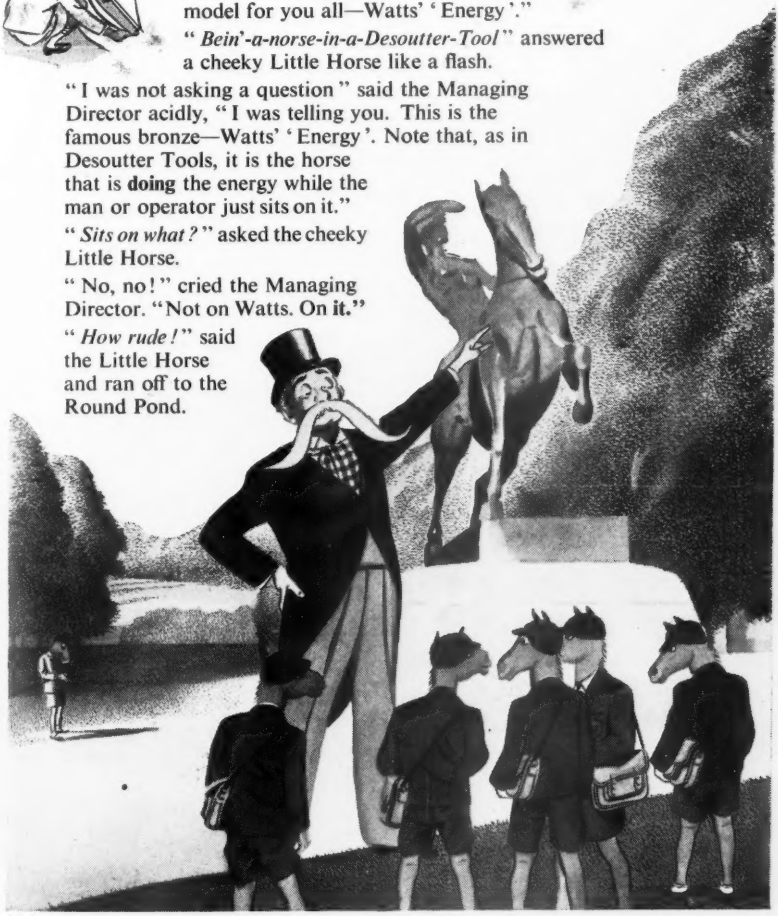
"*Bein'-a-norse-in-a-Desoutter-Tool*" answered a cheeky Little Horse like a flash.

"I was not asking a question" said the Managing Director acidly, "I was telling you. This is the famous bronze—Watts' 'Energy'. Note that, as in Desoutter Tools, it is the horse that is **doing** the energy while the man or operator just sits on it."

"*Sits on what?*" asked the cheeky Little Horse.

"No, no!" cried the Managing Director. "Not on Watts. On **it.**"

"*How rude!*" said the Little Horse and ran off to the Round Pond.



Desoutter Power Tools Increase Production

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42 SNJ Spire Speed Nuts are used to secure Radiator Shell; Steering Column Sealing Plate; Steering Column Blanking Rubber; Heater Blower Attachment Plate; Heater Blanking Piece; Bumper Valances; Heater Duct; Dash Cover Plate.

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Head Office & Works: Treforest, Glamorgan. Also Birmingham, Stockholm & Melbourne

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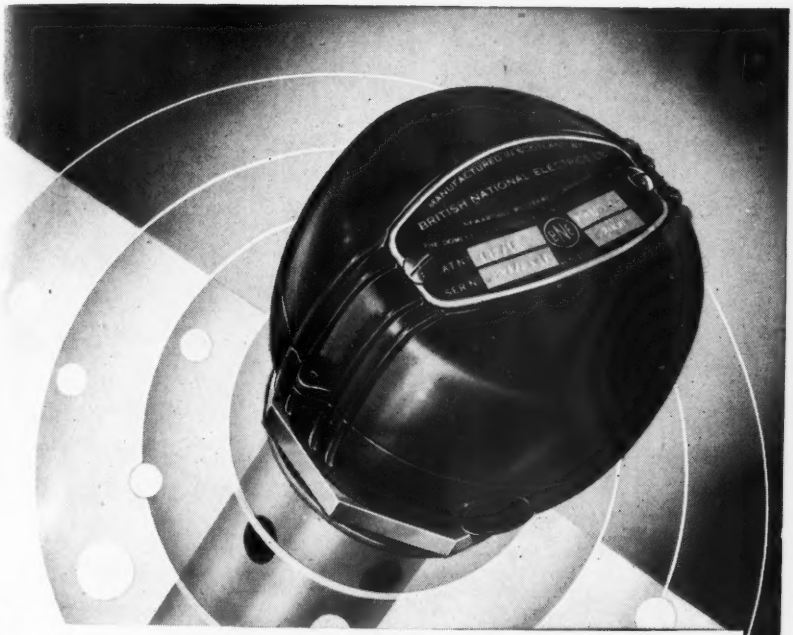

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Immersion Heaters and Circulators

★ Conform to B.S. 1556 ★ Are very easy to install ★ Combine the best features of the old 'Highlow' and 'Charlton' ranges.

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BRITISH NATIONAL ELECTRICS LIMITED

The Domestic Appliances Section of JOHNSON & PHILLIPS LTD.

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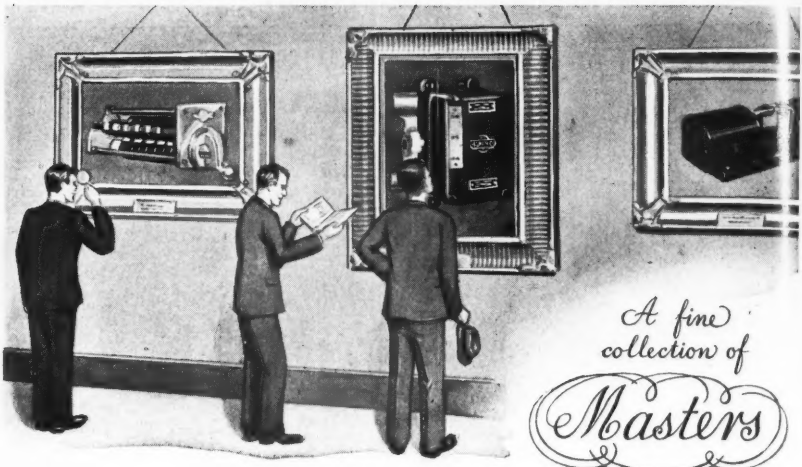

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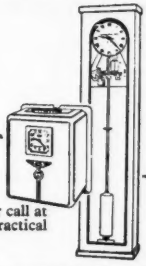

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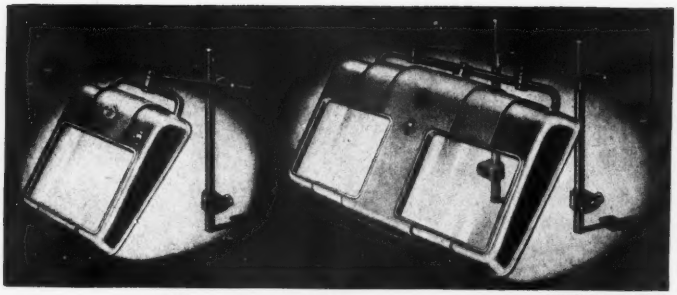

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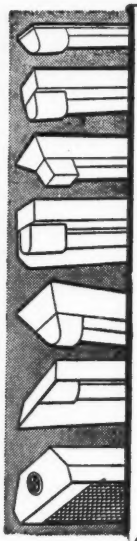

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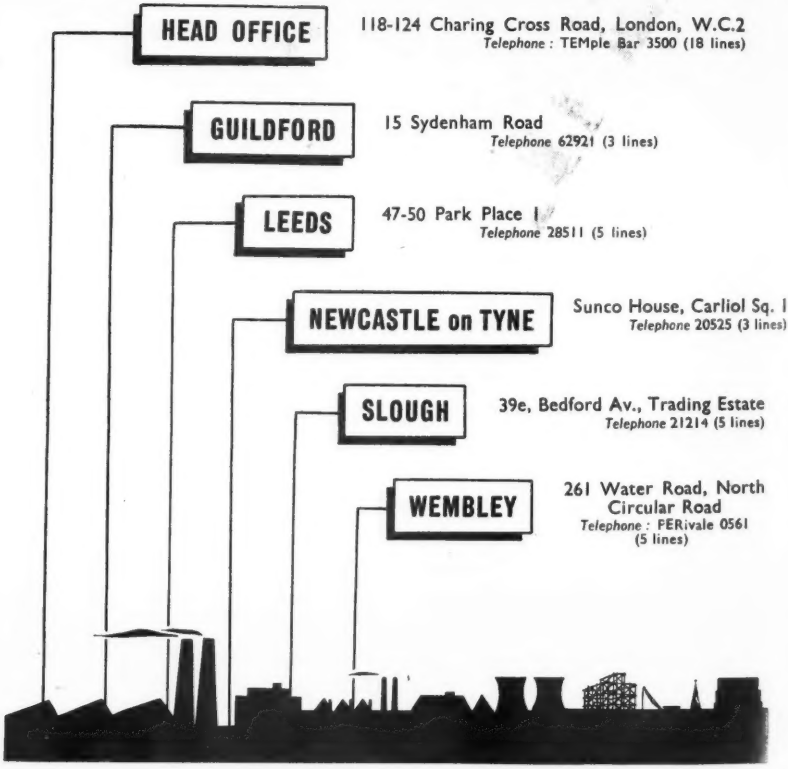

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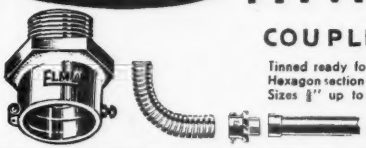

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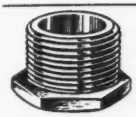

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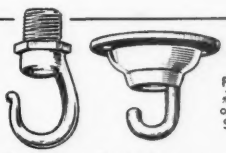

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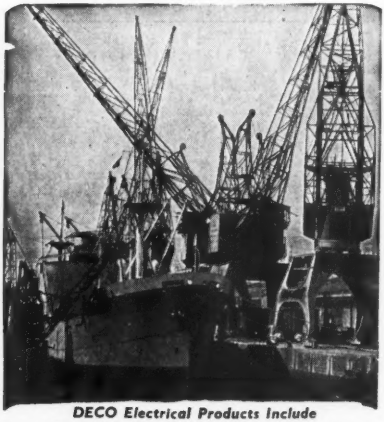

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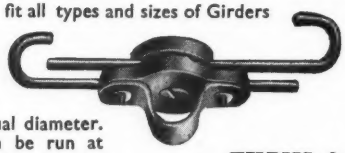

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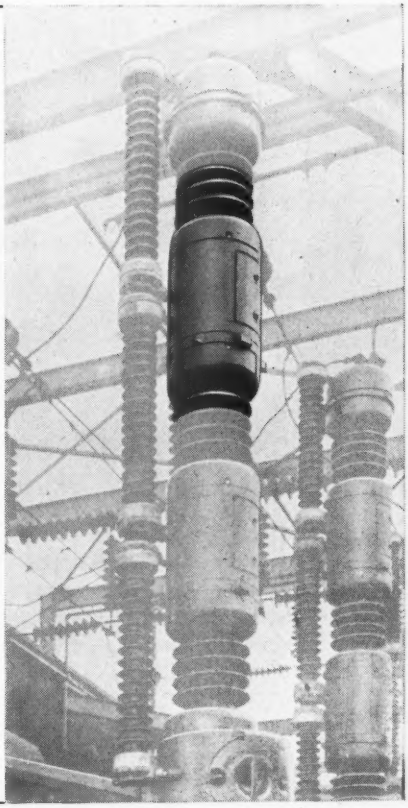

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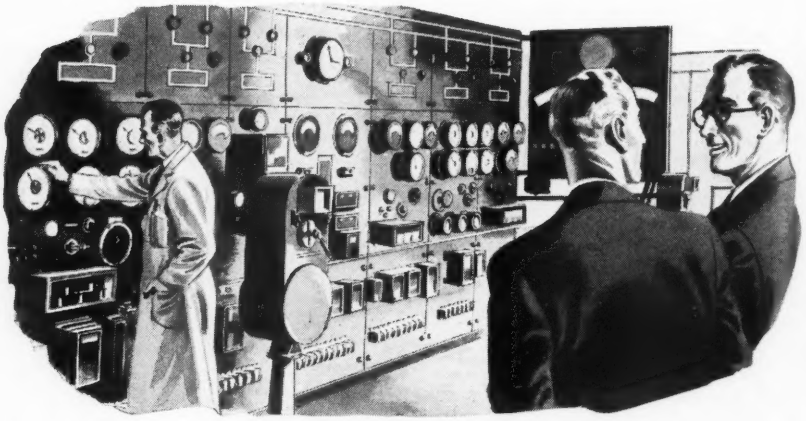

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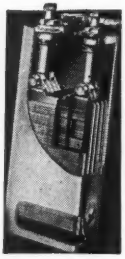

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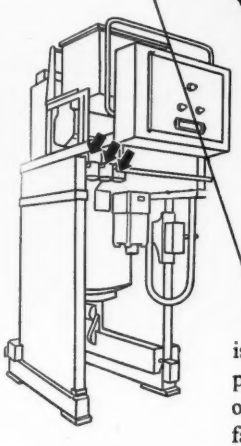

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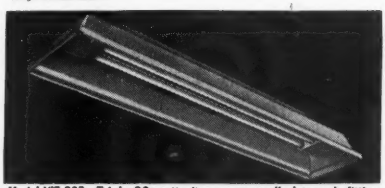

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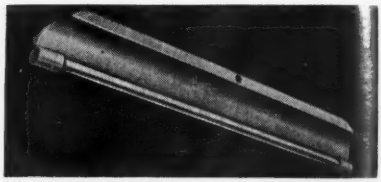

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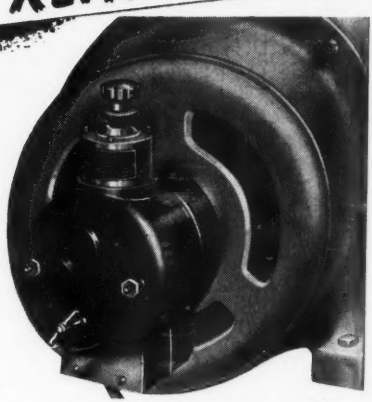

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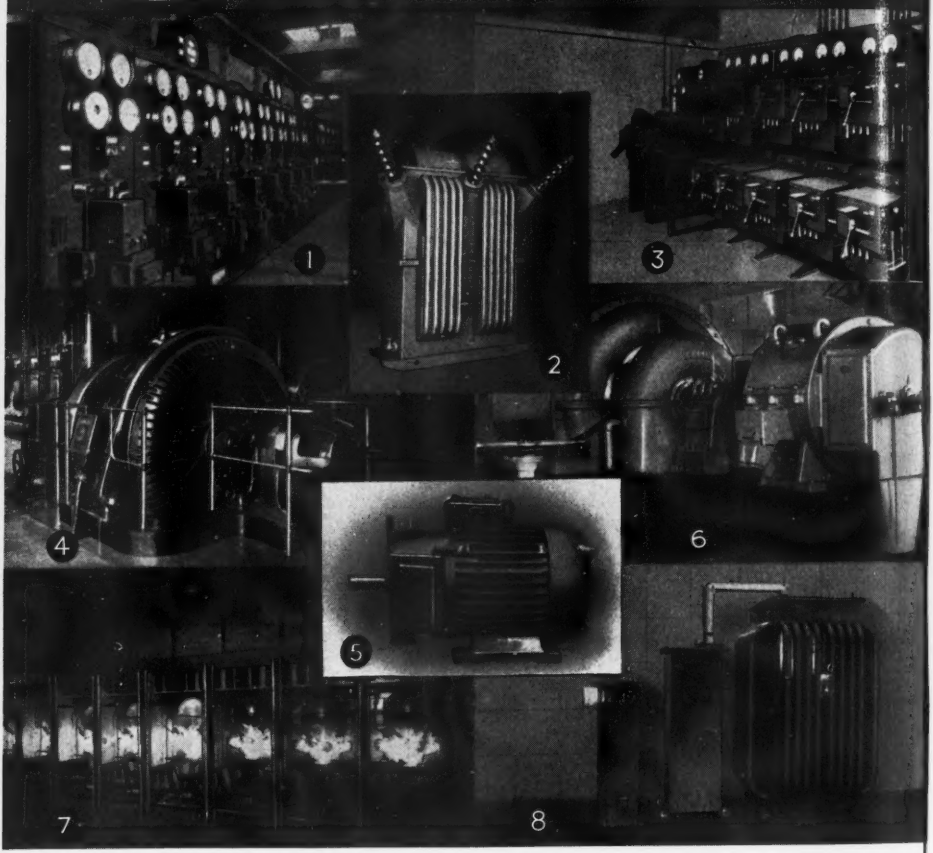

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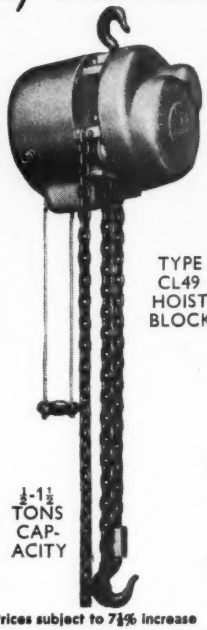

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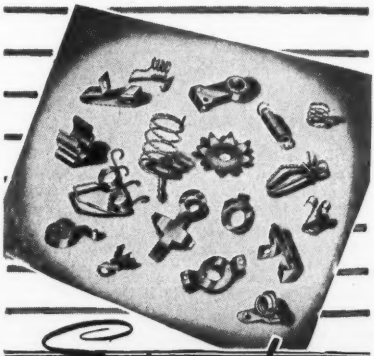

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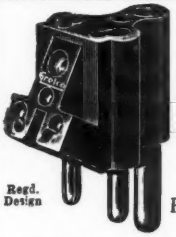

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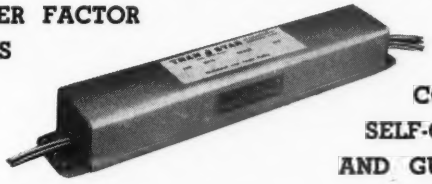

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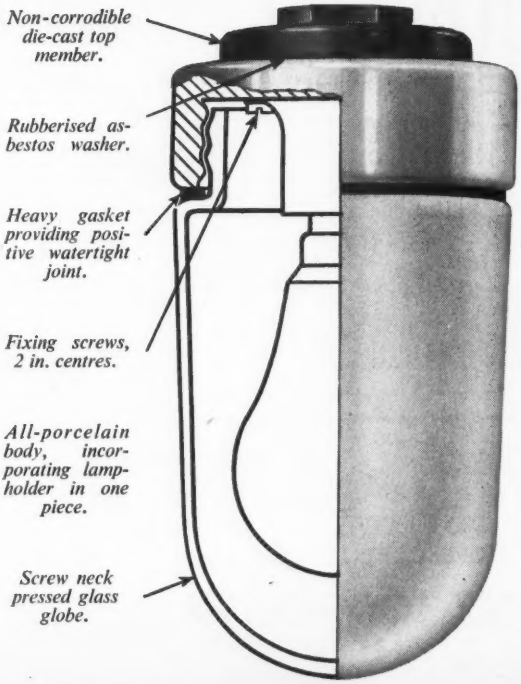
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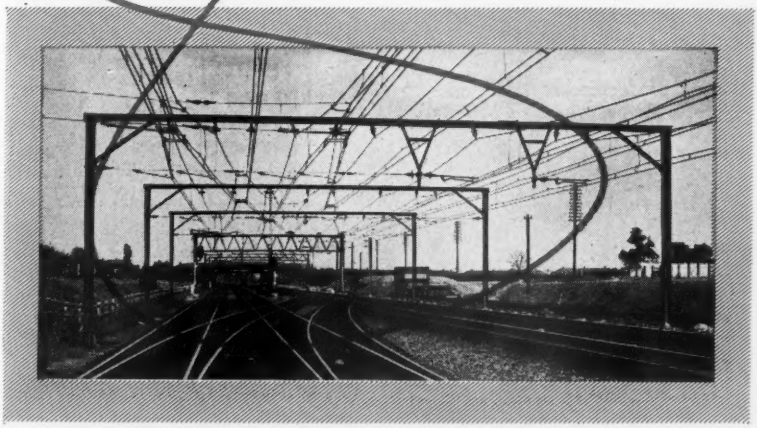

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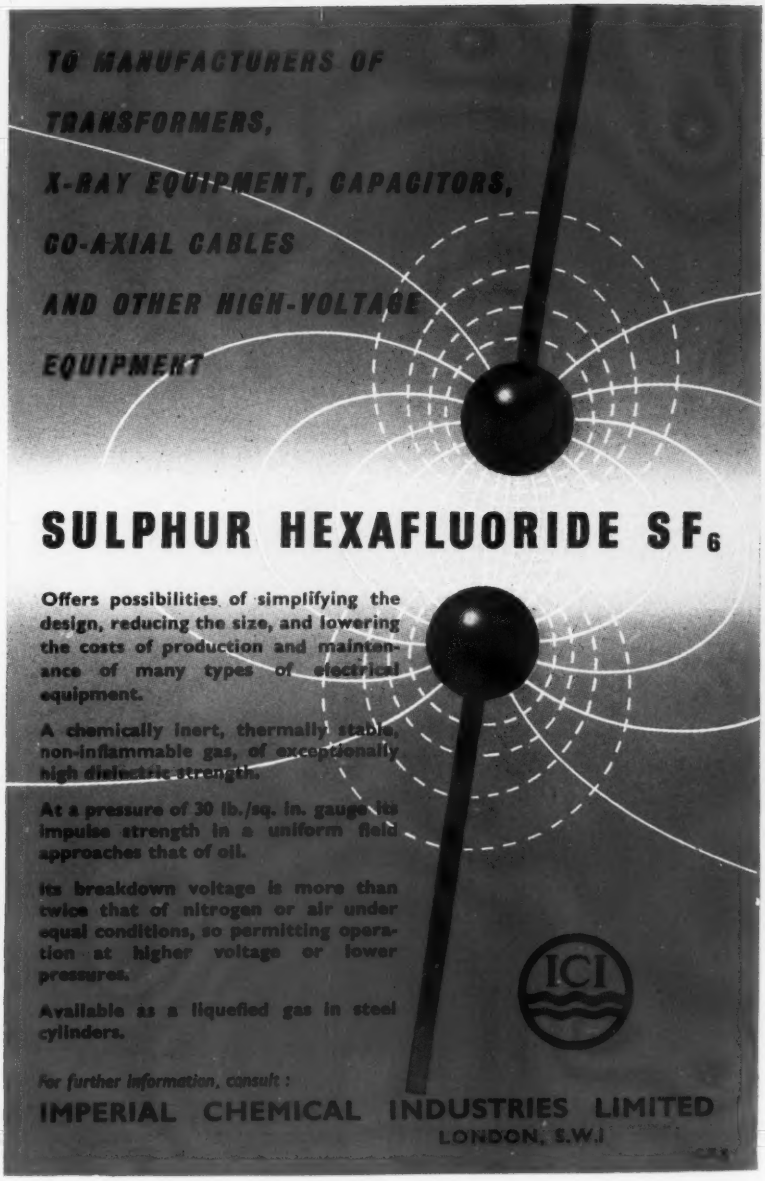
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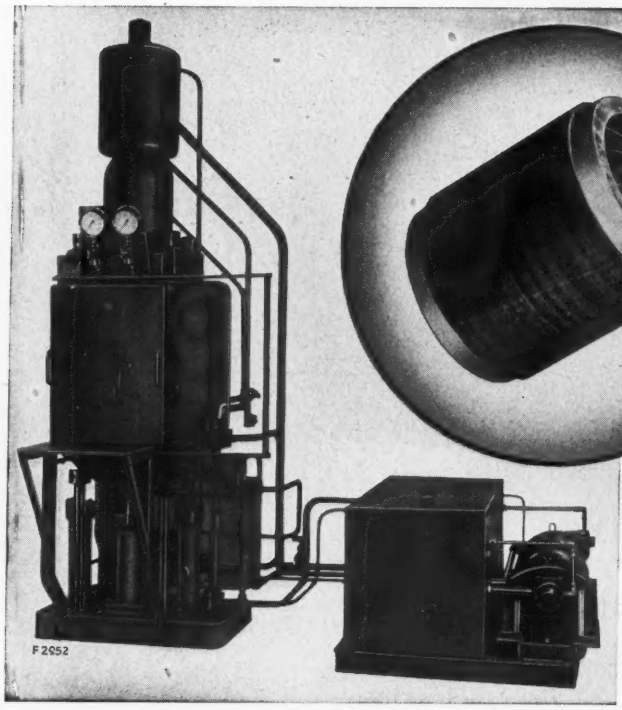

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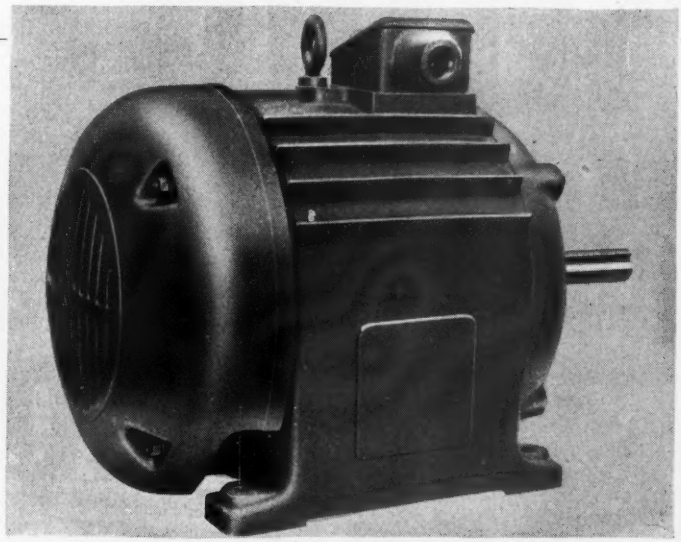

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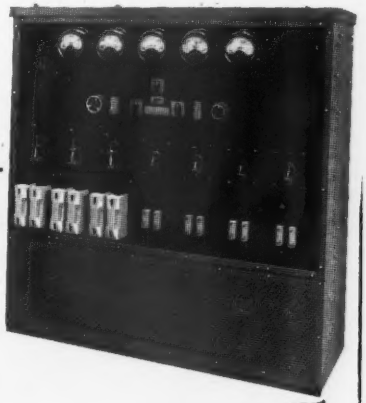

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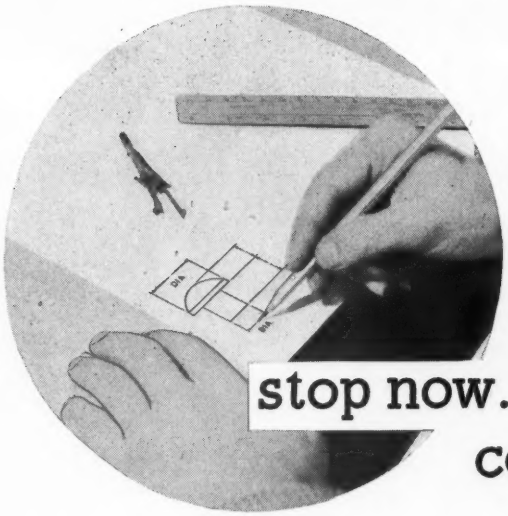

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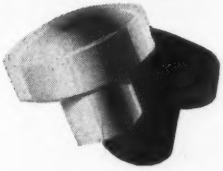

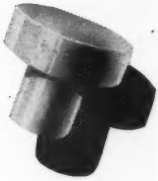

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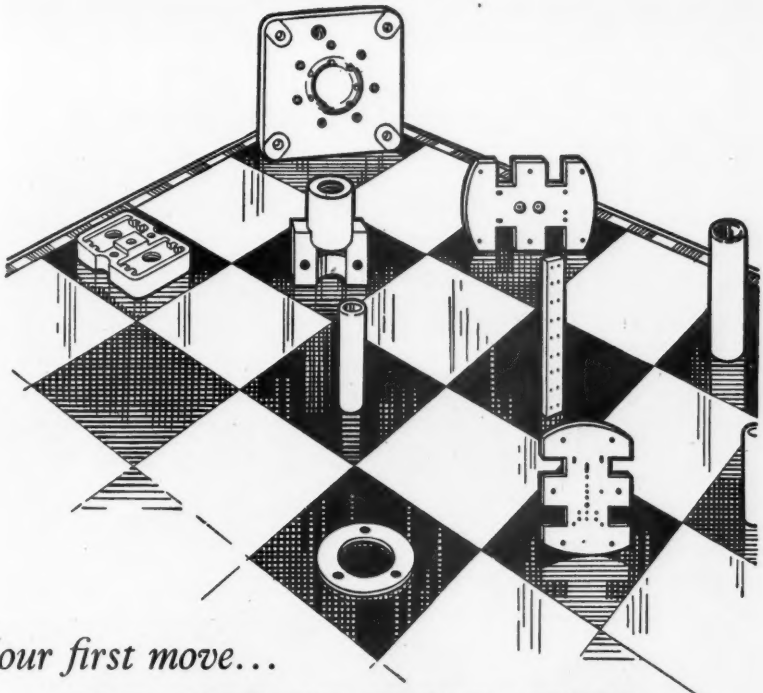

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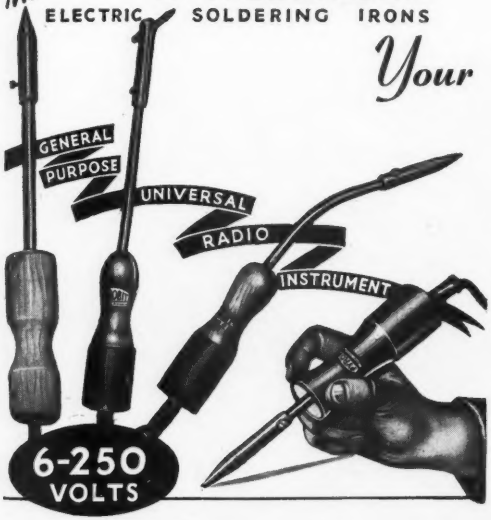

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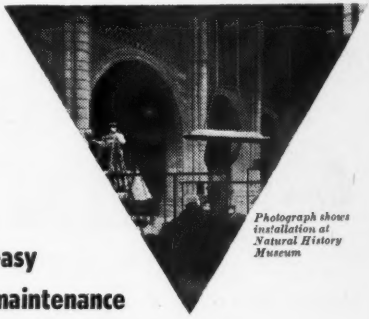
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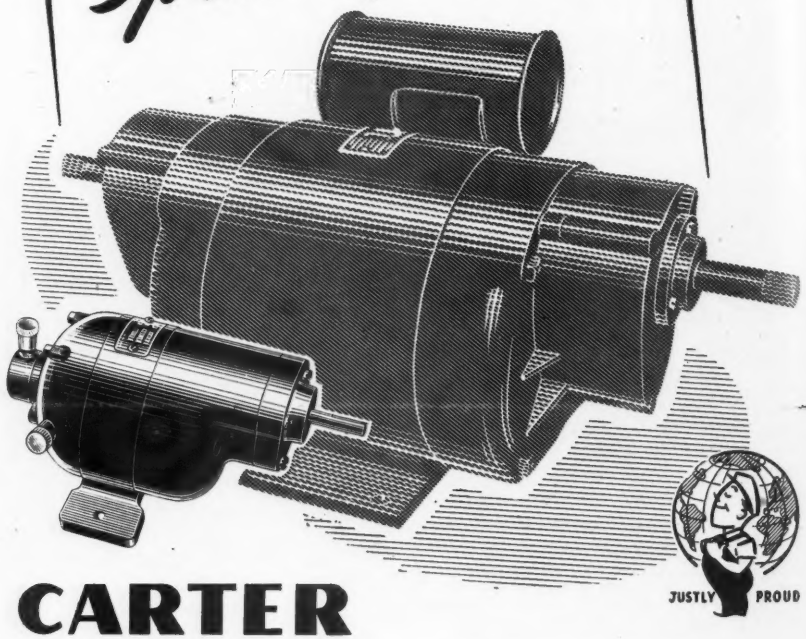

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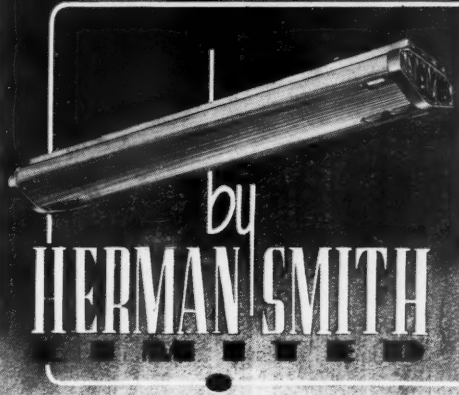

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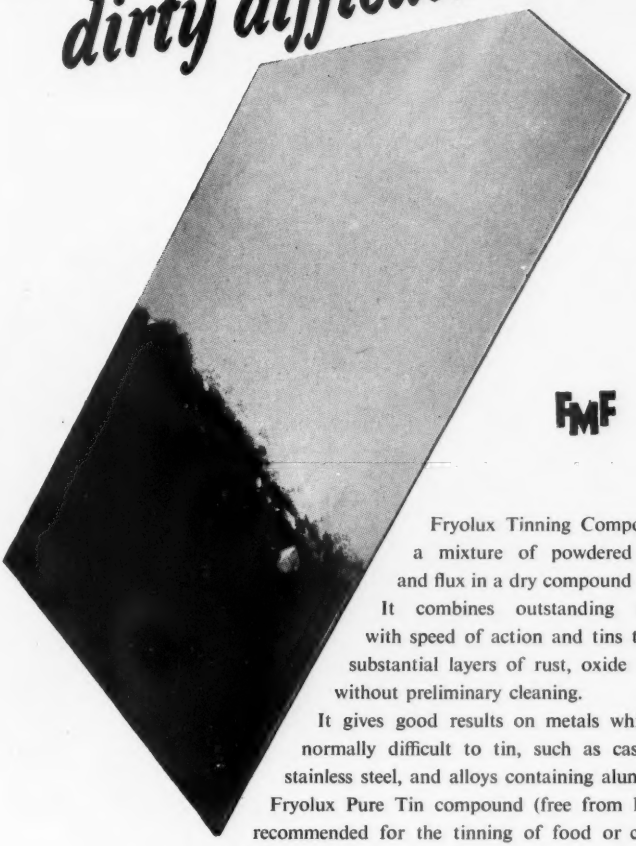

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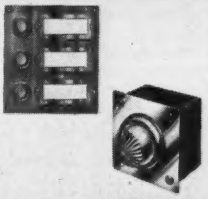

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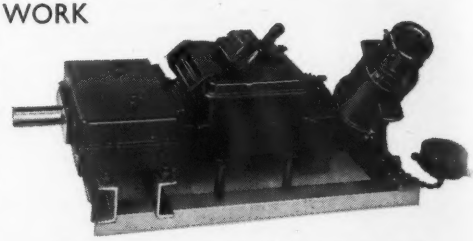

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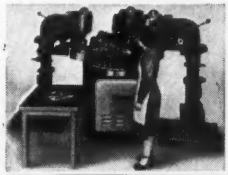

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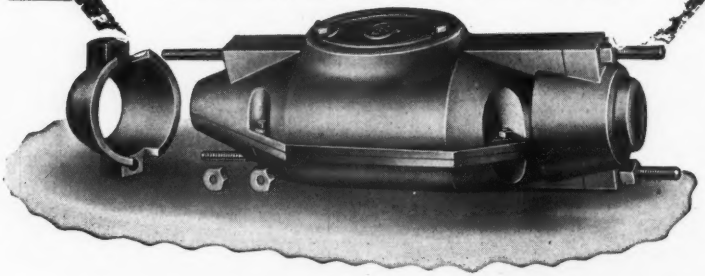

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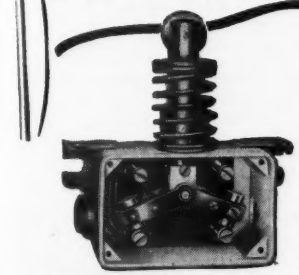

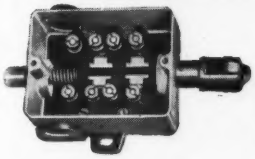

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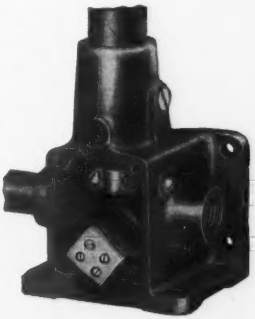

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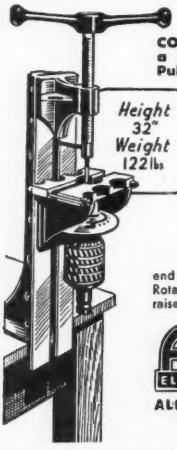

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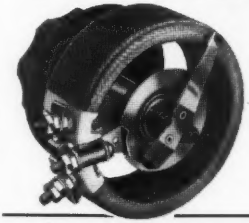

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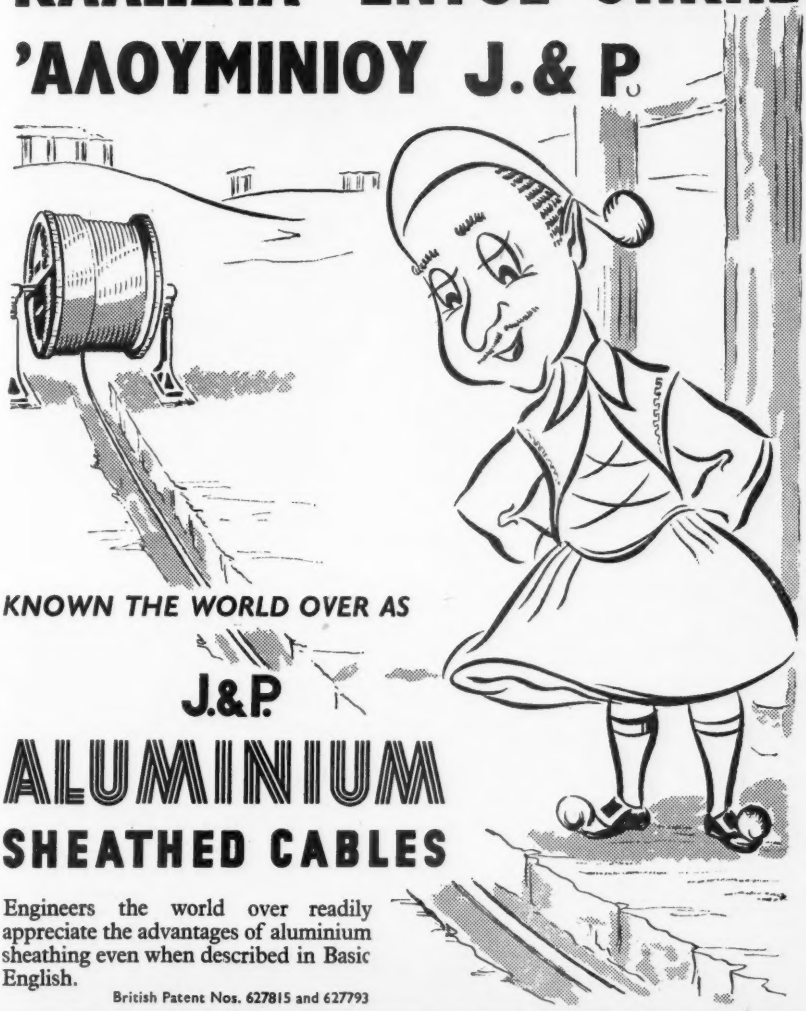

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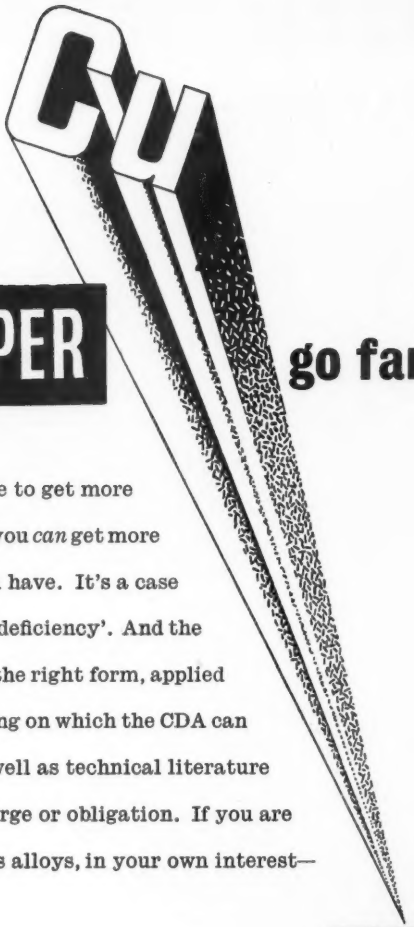

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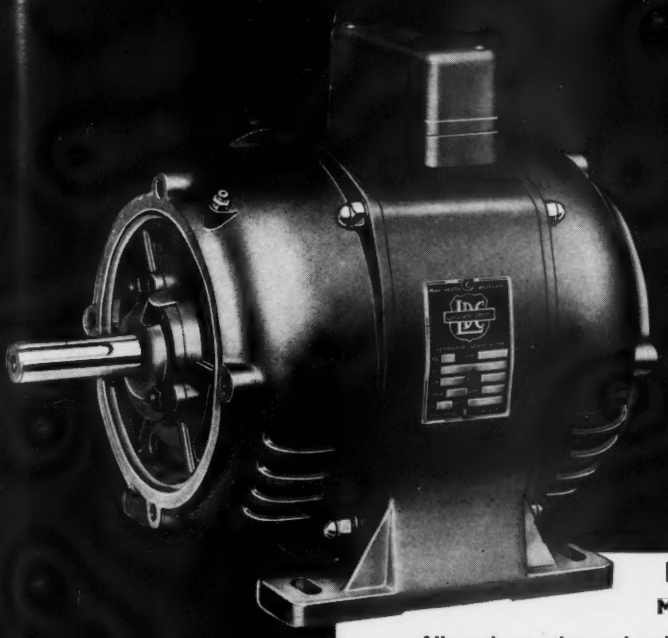

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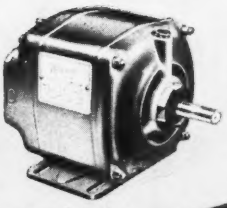

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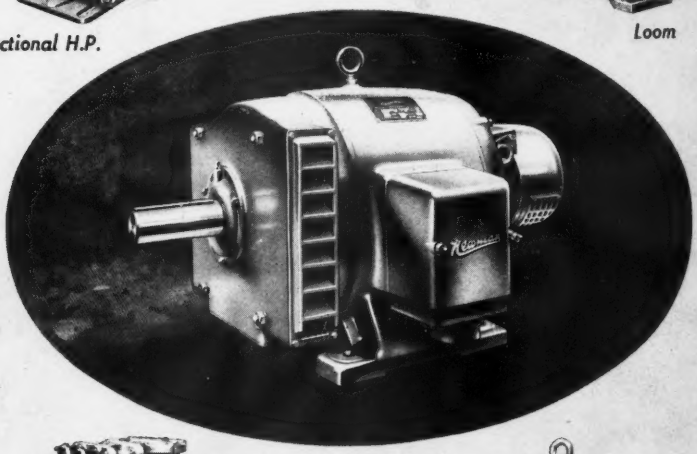

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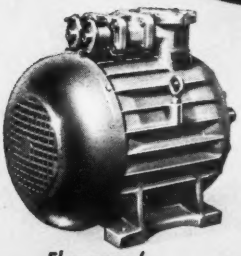

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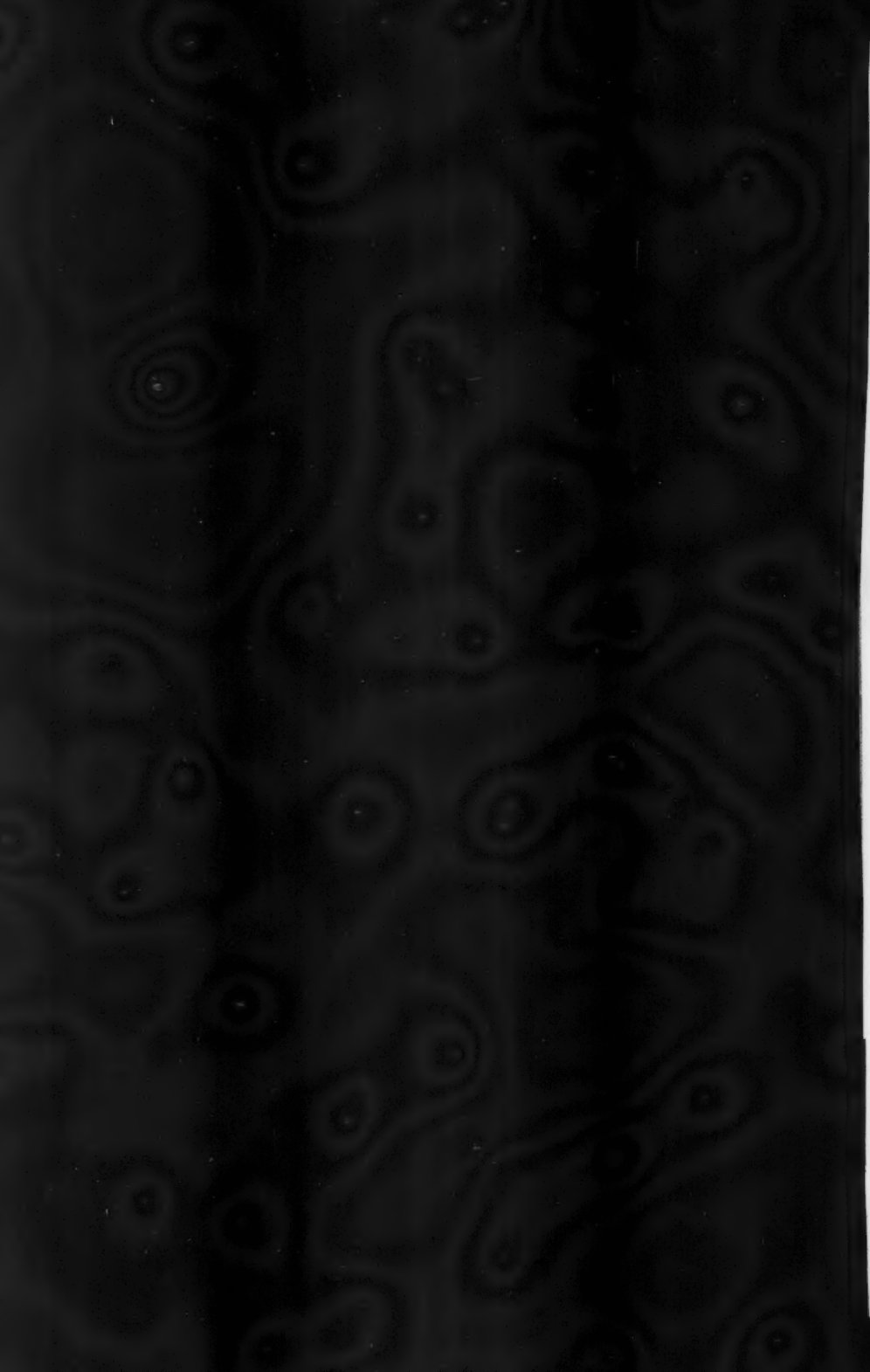

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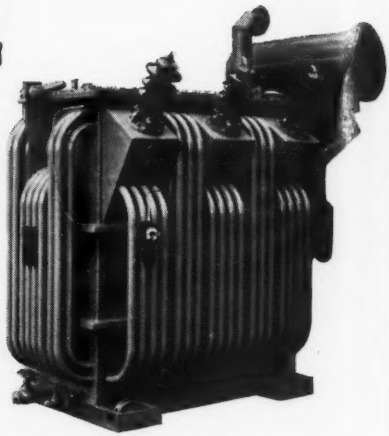

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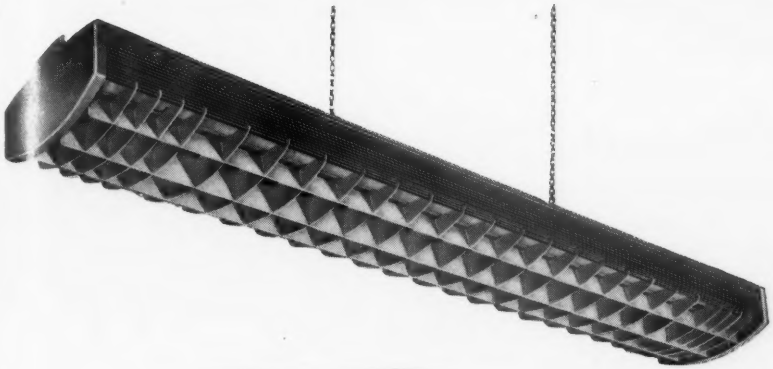

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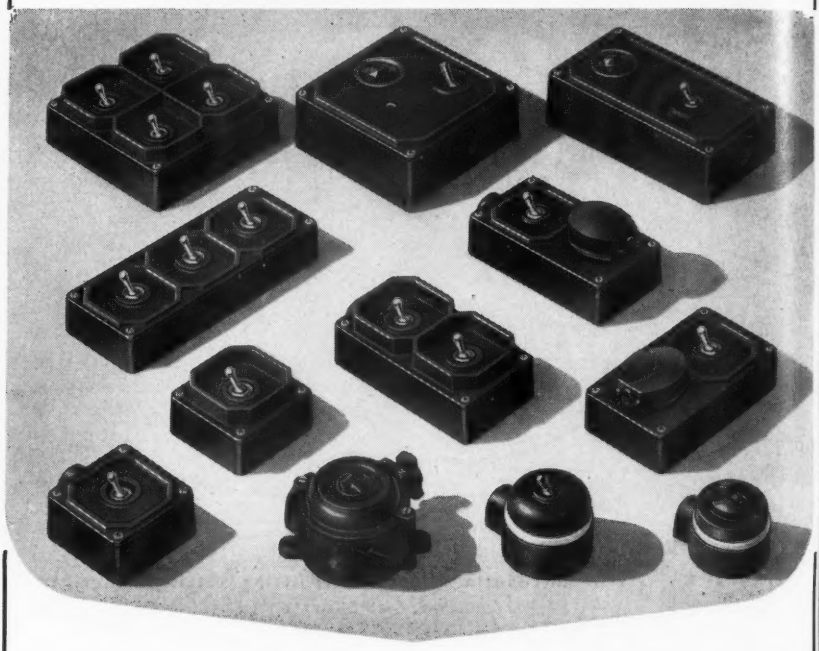

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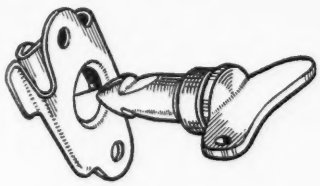

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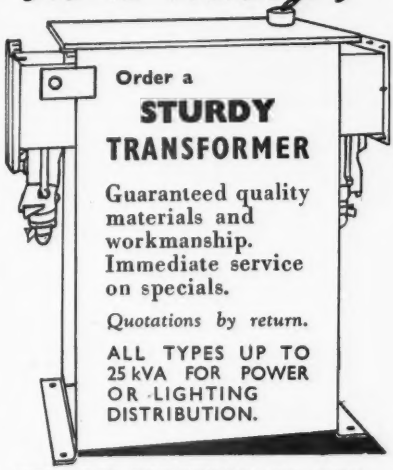

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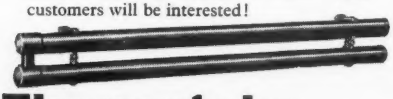

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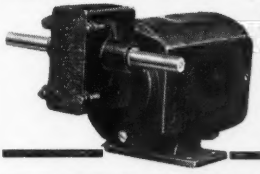

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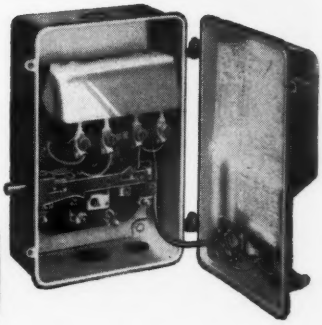

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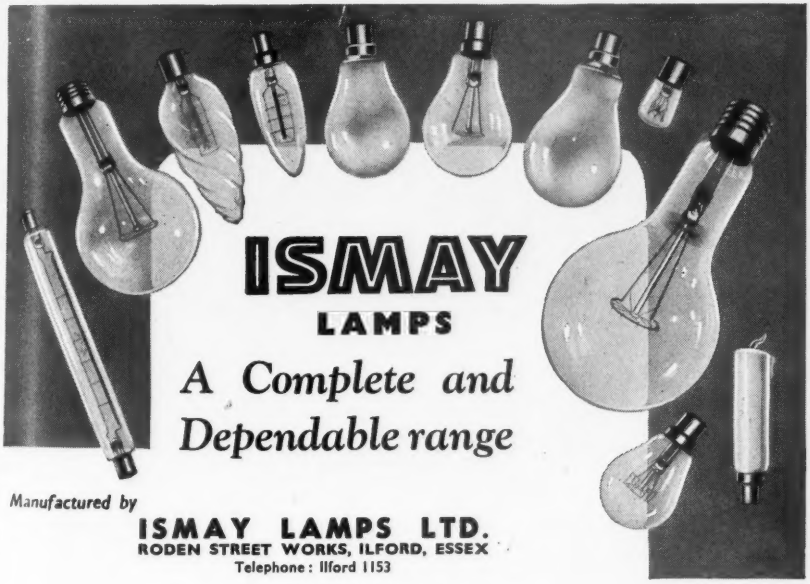

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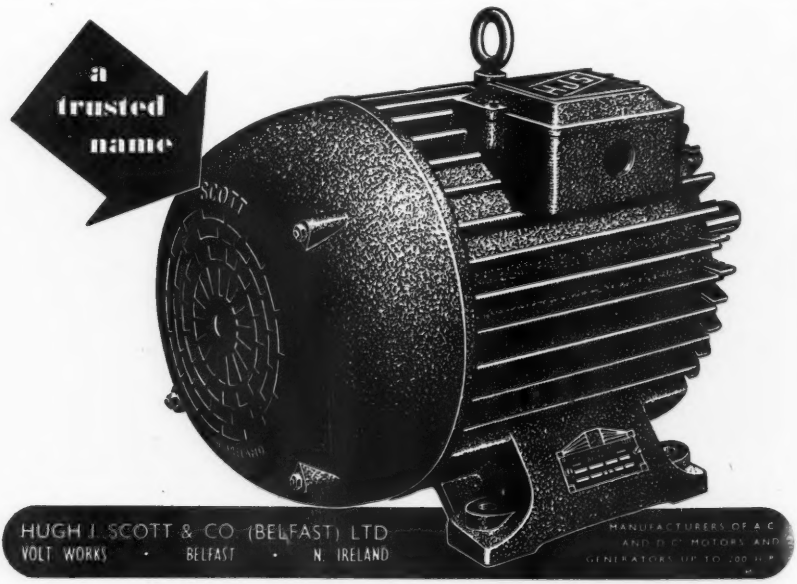

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The Industrial Lighting Reflectors embodying the Wardle Simple Detachable Top at no extra charge.

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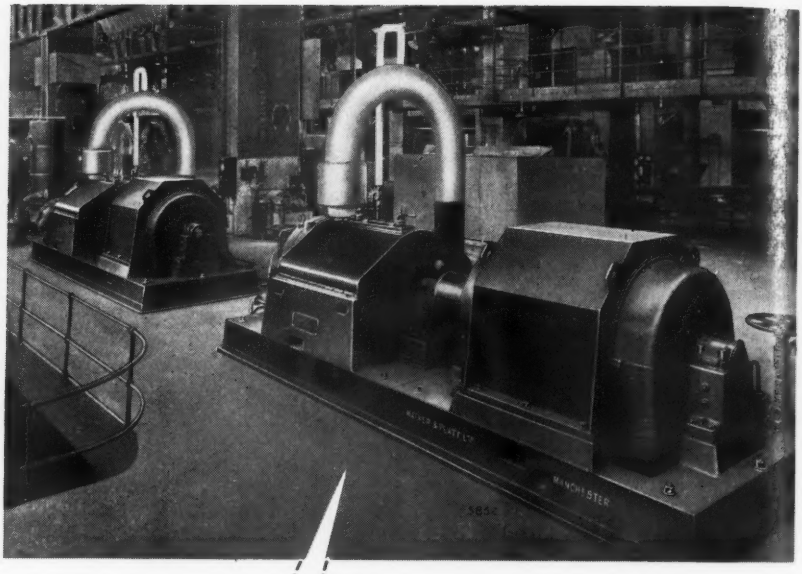

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The photograph shows two of four M. & P. boiler feed pump sets installed at a B.E.A. Generating Station. The pumps deliver 570,000 lb. per hour at 210° F. and 1,711 lb. per sq. inch. They are driven by M. & P. direct-on started squirrel cage motors (1,850 b.h.p., 6,000 V, 3,000 r.p.m.), taking a starting current of four times full load value.

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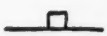
Small 

or large

or light

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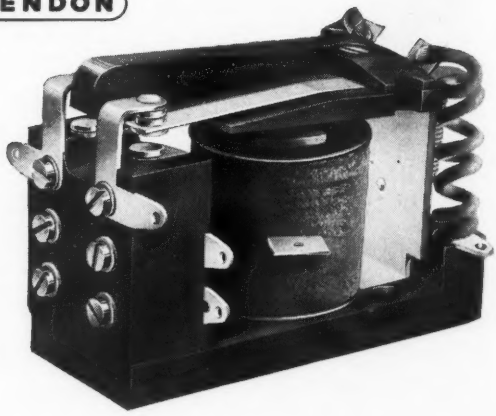

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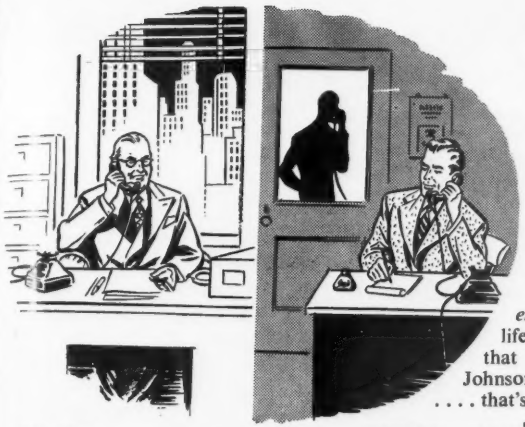

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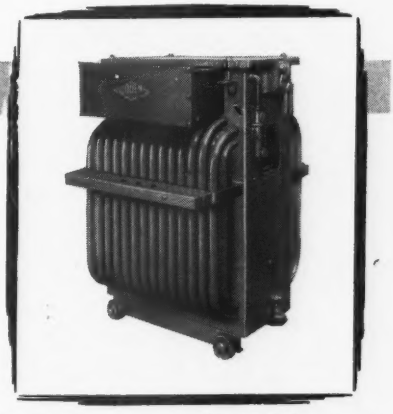

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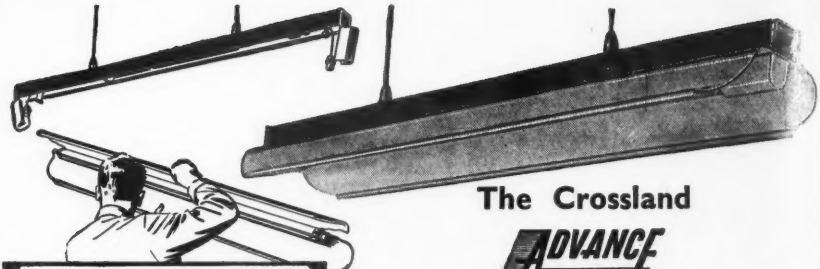

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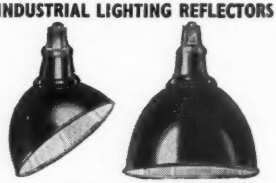

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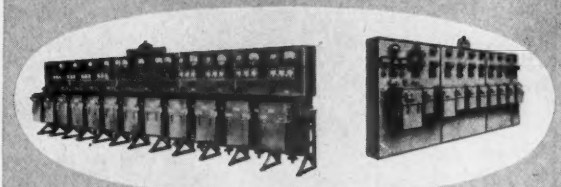

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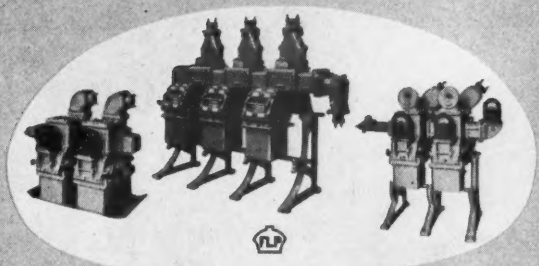

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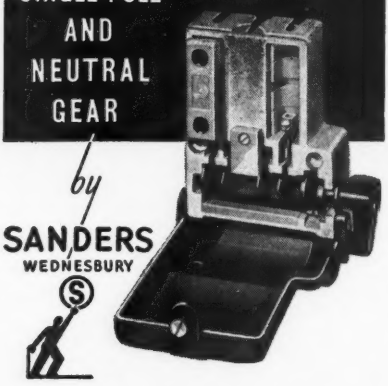

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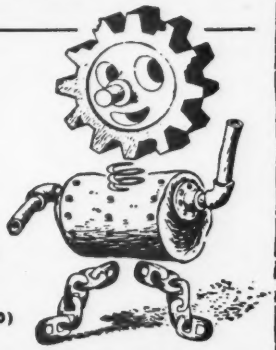

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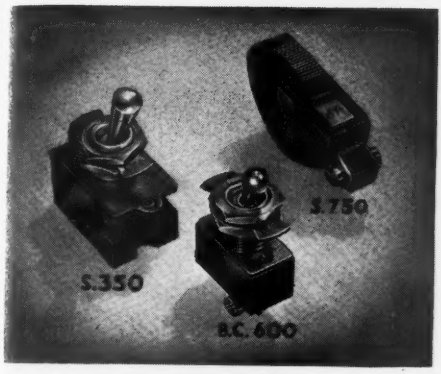

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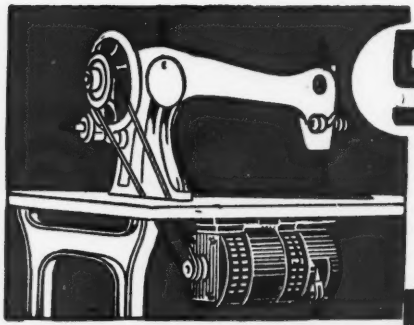

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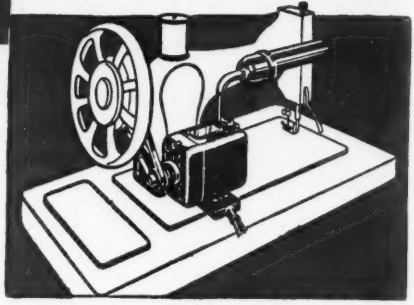

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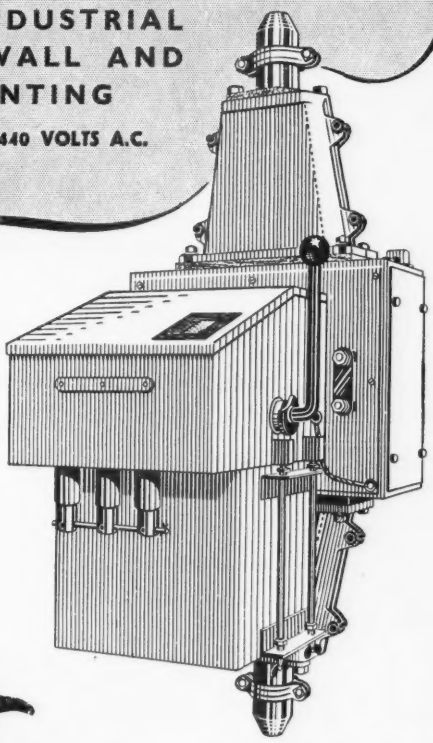

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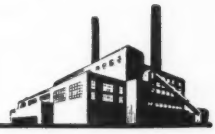
NO WASTE



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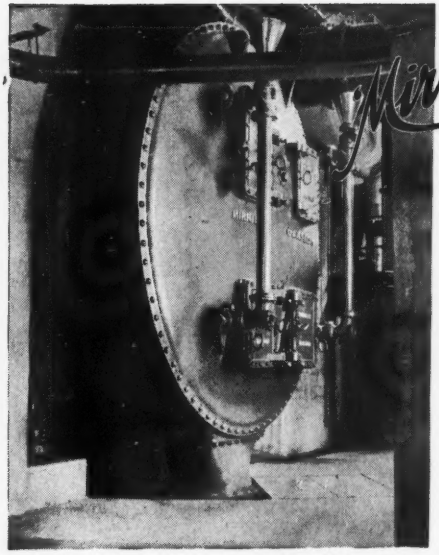

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AND AUXILIARIES

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Illustration shows: Water Box End of a 26,000 sq. ft. MIRRLEES Surface Condenser with Special Tube Cleaning Apparatus

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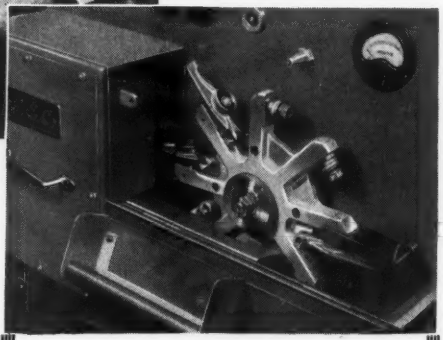
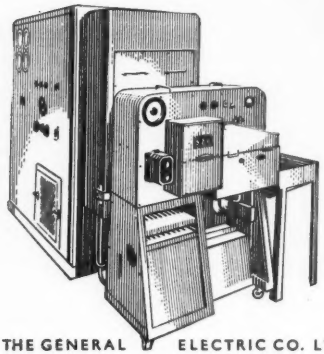
OUTPUT INCREASED *tenfold*

The rocker pad hardening machine is one of a range of complete G.E.C. high frequency heating equipments. It combines induction heating with automatic handling gear to give very high rates of production. The installation shown is hardening rocker pads approximately ten times as fast as the previous hardening method.



- Rocker pads go into a G.E.C. rocker pad hardening machine in the production line at the works of Leyland Motors Ltd.
- The indexed motor which carries the parts through the hardening process.



G.E.C.

H.F. HEATING EQUIPMENT

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 7 words) per insertion. Where the advertisement includes a Box Number this counts as two words and there is an additional charge of 1/-.

DISPLAYED:—£2 10s. per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BELFAST

Electricity Department

Victoria Power Station

TENDERS are re-invited for the supply, delivery and erection, etc., of:—

SECTION A. Two 48-inch bore and two 72-inch bore motor-operated sluice valves for installation in the condenser circulating water culverts, the valves to be complete with cast-iron specials for installing in reinforced concrete culverts, and 6 and 4-inch bore drain and air release valves.

SECTION B. Seven penstocks 5 feet wide by 10 feet high, three penstocks 3 feet wide by 13 feet high, and one penstock 6 feet wide by 13 feet high, these penstocks to be motor-operated with emergency hand-operating gear.

Tenders are required for the whole of the above work, but each section will be considered independently, and tenderers may quote for either Section A or Section B or both. The Corporation will consider only offers for the whole of the plant specified in each section.

Form of tender (No. N.1156), conditions and specification, in quadruplicate, may be obtained from Messrs. Merz & McLellan, Consulting Engineers, Carliol House, Newcastle-upon-Tyne, 1, on payment of a deposit of five guineas, which will be refunded provided a bona fide tender be lodged and not withdrawn. Extra copies of the contract documents may be obtained at three guineas per set; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Low Pressure Valves and/or Penstocks, Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 18th January, 1952.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered. The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
15th December, 1951. 5201

LANCASHIRE COUNTY COUNCIL

To Contractors

TENDERS are invited for the works involved in the provision of street lighting on the Warrington-Wigan-Preston Trunk Road A.49 in the Parish of Euxton.

Plans and details may be inspected at the offices of Mr. James Drake, B.Sc., M.I.C.E., M.I.Mun.E., County Surveyor and Bridgemaster, County Hall, Preston, at any time during customary office hours, and conditions of tender, conditions of contract, specifications, bill of quantities and form of tender may be obtained by depositing the sum of £2 (two pounds) with the County Surveyor and Bridgemaster. This deposit will be refunded only on receipt of a bona fide tender.

Cheques are to be made payable to the Lancashire County Council.

Tenders must be forwarded to the undersigned not later than 10 a.m. on Monday, the 7th January, 1952, in a sealed envelope which must not bear any name or mark indicating the sender.

R. ADCOCK,
Clerk of the County Council.

County Hall,
Preston. 5141

UGANDA ELECTRICITY BOARD

Owen Falls Hydro-Electric Power Station

TENDERS are invited for the supply, delivery (F.O.B. British Port) and installation of 11-kV and lower-voltage cables and accessories associated with generation plant and feeder circuits. Form of tender, conditions and specification, No. UEB.41/26, in triplicate, may be obtained from Messrs. Kennedy & Donkin, Alliance House, 12, Caxton Street, London, S.W.1, on or after 2nd January, 1952, on payment of a deposit of £2 2s., which will be refunded upon receipt of a bona fide tender or return of documents. Extra copies of the contract documents may be obtained at £2 2s. per set, which sum will not be returnable. Cheques should be made payable to the Uganda Electricity Board.

Tenders must be submitted in duplicate in a sealed envelope endorsed on the left-hand corner "Tender for Specification UEB.41/26," and addressed to the Chairman, Uganda Electricity Board, c/o Messrs. Kennedy & Donkin, Alliance House, 12, Caxton Street, London, S.W.1, and delivered not later than 12 o'clock noon on the 11th February, 1952.

The Board do not bind themselves to accept the lowest or any tender. 5176

SITUATIONS VACANT

SOUTHERN ELECTRICITY BOARD

APPLICATIONS are invited for the following posts:—

PERSONNEL OFFICER. A vacancy will shortly exist for a Personnel Officer on the staff of the Secretary at the Head Office of the Board.

The commencing salary will be within the range of £1,250-£2,000 per annum according to qualifications and experience, and the conditions of service will initially be those prescribed by the Board from time to time. The salary and conditions of service will, in due course, be those determined by the appropriate negotiating machinery. Candidates should have a wide knowledge of all personnel matters, preferably obtained within the electricity supply industry, and a considerable experience of the negotiation and application of agreements covering wages, salaries and conditions of service. The duties of the successful candidate will include co-ordinating responsibilities in respect of training, establishment and welfare policy.

Forms of application, obtainable from the Secretary, should be returned to him in envelopes endorsed "Personnel Officer" at Southern Electricity House, Littlewick Green, Maidenhead, not later than 14th January, 1952.

MAINTENANCE AND OPERATION ENGINEER, Sub-Area Engineer's Department, Portsmouth. Salary, N.J.B. Class J, Grade 7, Column 1 (£792 per annum). N.J.B. conditions of service.

The person appointed will be responsible to the Sub-Area Engineer for the co-ordination of maintenance and operation in the whole of No. 3 (Portsmouth) Sub-Area.

Candidates must have had experience in the operation and maintenance of large distribution networks involving sub-station plant and equipment and mains up to 33 kV. Applicants should preferably be Corporate Members of the Institution of Electrical Engineers, or have equivalent qualifications.

Applications, on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, must be returned to him in envelopes endorsed "Maintenance and Operation Engineer" not later than 7th January, 1952.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

F. W. KEMPTON, Secretary.

21st December, 1951. 5142

LONDON ELECTRICITY BOARD

Senior Draughtsman, Engineering Draughtsmen and Drawing Office Junior

APPLICATIONS are invited for the following appointments in the South Western Sub-Area. The successful applicants will be required to work initially at the locations shown, but must be prepared in the future to work at any other drawing office within the Sub-Area.

SENIOR DRAUGHTSMAN at Wimbledon, S.W.19. Candidates should have good technical qualifications and considerable experience in recording and design of distribution systems, including layout of sub-stations, and be capable of supervising engineering draughtsmen and junior draughtsmen. A knowledge of building construction would be an advantage.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 5, £574 7s. to £683 11s. per annum, inclusive of London allowance.

ENGINEERING DRAUGHTSMEN at Wimbledon, S.W.19, and Clapham Junction, S.W.11. Candidates should have had a good technical education and should be neat and accurate draughtsmen with experience in the preparation and maintenance of mains records and system diagrams, including the associated calculations.

The posts are graded under Schedule D of the National Joint Board Agreement as Grade 6, £438 to £574 7s. per annum, inclusive of London allowance.

DRAWING OFFICE JUNIOR (Male) at Mitcham, Surrey. Candidates should preferably have had or be undergoing technical education and have had experience in a drawing office of tracing and printing. Cartographic experience would be an advantage.

The post is graded within the National Joint Council (General Clerical Scale), salary ranging from £165 per annum at age 16 to £385 per annum at age 26, inclusive of London allowance.

Application forms obtainable from the Establishments Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 12th January, 1952, stating clearly the particular appointment for which application is made. Please enclose addressed foolscap envelope and quote ref. V/1388/R on all correspondence. 5177

COUNTY BOROUGH OF SOUTHEND-ON-SEA

Chief Heating and Ventilating Engineer

APPLICATIONS are invited for the above appointment in the Borough Architect's Department. Salary A.P.T. Division, Grade VI (£645 × £20 (2) × £25 to £710 per annum).

Candidates should be Associate Members of the Institution of Heating and Ventilating Engineers (by examination) with experience of the design, layout estimating and supervision of the installation and maintenance of low-pressure hot water heating systems, hot and cold water and gas services, ventilation for schools and other buildings. Experience in electric lighting and power systems will be an advantage.

The appointment will be subject to the National Joint Council's Scheme of Conditions of Service, and will be terminable by one month's notice on either side. Medical examination.

Applications, stating age, qualifications, experience and copies of three references, should be sent to the undersigned not later than 21st January, 1952.

ARCHIBALD GLEN, Town Clerk.

18th December, 1951. 5208

CENTRAL WATERPOWER IRRIGATION AND NAVIGATION COMMISSION, INDIA

THE COMMONWEALTH RELATIONS OFFICE invite application for the post of ELECTRICAL ENGINEER for service with the Central Waterpower Irrigation and Navigation Commission, India. Applicants must be regularly trained electrical engineers, preferably about 45 years of age, with considerable practical experience in generation, distribution and utilisation of electricity. The duties are concerned with the erection of power station plant, electrical transmission, distribution and the operation of electrical machines and equipment required for large-scale hydro schemes. The successful candidate will be required to guide and train the Indian engineers under his control. The appointment is for 2-3 years. Salary to be negotiated, but would be not less than £2,500 p.a. In addition, board and lodgings would be provided or a tax-free allowance to cover its cost.

Application forms from Ministry of Labour and National Service (K), Almack House, 26 King Street, London, S.W.1, quoting reference No. D567/51-O-A. Closing date 19th January, 1952. 5192

FOREIGN OFFICE ADMINISTRATION OF AFRICAN TERRITORIES

APPLICATIONS are invited for the following appointments in the Public Works Department under the Government of Cyrenaica.

(1) An ELECTRICAL & MECHANICAL ENGINEER for the design of new and modification of existing diesel power and pumping stations, overhead and underground distribution up to 11 kV, as suited to small towns. Candidates should be Graduates of the I.E.E. or hold a Higher National Certificate and have experience in power supply undertakings. Knowledge of mechanical engineering, public lighting and industrial installations would be an advantage. Salary scale £525 × £20 to £625 per annum. (Ref. D559/51-O.)

(2) An ELECTRICAL MECHANIST for erection of new main switchgear, installation and maintenance of motors and control gear in small pumping stations and modernisation of town distribution systems up to 11 kV. Candidates should have had an electrical engineering training, hold a H.N.C. or O.N.C. in electrical engineering, and have had supervisory experience of power distribution in urban districts. Experience with I.C. engines would be an advantage. Salary scale £400 × £15 to £475 per annum. (Ref. D560/51-O.)

In addition, a foreign service allowance of £160-£500 p.a. will be payable, according to individual circumstances. Contracts for two years, subject to medical examination, renewable by mutual agreement. Salary is not liable to U.K. income tax (Schedule E) and foreign service allowance is free of tax. There is at present no local tax. The climate of Cyrenaica is pleasant, healthy and suitable for British families. Home leave is granted at the rate of 72 days for each two years of resident service; local leave at the rate of 18 days annually. Leave passages for officials and their families, as well as passages on first appointment and on termination of contract, are at Government expense.

Application forms from Ministry of Labour and National Service, Technical and Scientific Register (K), Almack House, 26, King Street, London, S.W.1, quoting appropriate reference number. Closing date, 12th January, 1952. 5180

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

Junior Engineer, Hinckley

APPLICATIONS are invited for the position of JUNIOR ENGINEER at Hinckley Generating Station. Applicants should have had a sound technical training and experience in power station operation would be an advantage.

Salary will be in accordance with Class B, Grade 12, £389-£405 per annum, of the National Joint Board Agreement.

The post will be superannuable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, and should be returned not later than 14th January, 1952.

L. F. JEFFREY,

14th December, 1951. Divisional Controller. 5204

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

APPLICATIONS are invited for the following appointment:—

SECOND ASSISTANT DISTRICT ENGINEER (Huddersfield) (Vacancy No. 148/51). Applicants should hold qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers, and must have had a sound practical training and extensive experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, sub-station plant and ancillary equipment.

Salary: N.J.B. Agreement, Class D, Grade 7, £704/£733 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, within fourteen days of the appearance of this advertisement. 5148

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments at Northmet Sub-Area Headquarters:—

CIVIL ENGINEERING AND BUILDINGS: SECOND ASSISTANT ENGINEER (126/51R). In collaboration with the Board's Architect at Wherstead, Ipswich, the successful candidate will be in charge of the design, construction and maintenance of all buildings and civil engineering works, including bulk supply and distribution substations, offices, service centres, stores and workshops. He will be required to assist in the acquisition of land, including licensing and planning negotiations, the control of drawing office staff, and the general supervision of contracts.

The salary will be in accordance with Class M, Grade 7, of the National Joint Board Salary Agreement, commencing at £961 p.a. plus £48 p.a. London allowance.

ENGINEERING DRAUGHTSMEN (127/51R) in either of the following branches:—

Sub-stations. Layout of switchgear, transformers and associated equipment for outdoor and indoor type sub-stations up to 33 kV.

Mains. Overhead line design and layout of associated equipment, underground cable trench sections, survey and route plans, and general mains recording maps and plans.

The salary for these appointments will be in accordance with Grade 6, Schedule D, of the National Joint Board Salary Agreement, within a salary range of £438 to £574 p.a., including London allowance.

Future salaries and conditions of service for the above appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14, within fourteen days of the appearance of this advertisement. 5143

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment:—STATION SHIFT CONTROL ENGINEER, Great Yarmouth Generating Station.

Salary in accordance with N.J.B. Schedule A, Grade 10, Class D (£511-£527 per annum).

Applicants should have reached the standard of Ordinary National Certificate in Electrical Engineering or its equivalent, have experience in the operation of a switchboard at a generating station and be fully conversant with high voltage switching operations and protective systems.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications stating age, experience and present position should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than 5th January, 1952.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. 5202

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the position of DEMONSTRATOR in the North Staffordshire Sub-Area. Applicants should have had a good general education, and the possession of a recognised diploma in domestic science and electricity housecraft will be an advantage. Duties will include the conducting of lecture demonstrations both in the service centres and on consumers' premises and advice to consumers on the selection and use of electrical apparatus.

Salary and conditions of service will be in accordance with the N.J.C. Grade 1, within the range of £360/£400 per annum, with further progress to £440 per annum, subject to satisfactory service. The successful applicant will be required to contribute to the Board's Superannuation Scheme, if eligible.

Training will be given where necessary to a suitable applicant.

Applications, in writing, stating age, education, etc., should be forwarded within fourteen days to Sub-Area Manager, Midlands Electricity Board, 31, Kingsway, Stoke-on-Trent.

A. STEPHENS, Secretary. 5195

ELECTRICITY SUPPLY BOARD, IRELAND

Vacancies

THE Electricity Supply Board, Ireland, invites applications from:—

(i) University graduates with degrees in Mechanical or Electrical Engineering.
(ii) Corporate Members of the Institution of Mechanical or of the Institution of Electrical Engineers.
(iii) Graduates of the Institution of Mechanical or of the Institution of Electrical Engineers.

Vacancies exist in the Board's organisation for:—

A: SHIFT ENGINEERS in generating stations; working hours per week, 42.

B: NON-SHIFT ENGINEERING AND TECHNICAL POSITIONS in generating stations and various departments.

For posts under A, the salary scale applicable is £483-£846 (including cost-of-living bonus) plus an allowance of 12½% in respect of shift work. Preference will be given to candidates who have had suitable experience in a modern steam generating station or in a railway or dockyard works or in the works of a manufacturer of generating station mechanical plant.

For posts under B, the salary scale for staff holding a University degree or Corporate Membership of either of the Institutions is £483-£846 (including cost-of-living bonus); the scale for Graduates of the Institutions will depend on qualifications and experience.

Each application should state briefly candidate's age, technical training and qualifications, date of graduation or Corporate Membership, and practical experience, and should indicate the type of vacancy for which the candidate wishes to be considered. If an applicant wishes to be considered for alternative types of employment, his order of choice should be stated.

Applications should be addressed to the Personnel Officer, 27, Lower Fitzwilliam Street, Dublin, and should reach him not later than Saturday, 5th January, 1952.

PATRICK J. DEMPSEY, Secretary. 5205

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable positions with salary and conditions of service in accordance with N.J.B. Schedule:—

TURBINE HOUSE SUPERINTENDENT, FULHAM GENERATING STATION. Candidates should have received a sound mechanical and electrical engineering training with a first-class technical background. A wide experience is necessary in the efficient operation and maintenance of large modern generating plant and auxiliary equipment, together with ability to plan and organise work to a strict time schedule.

The engineer appointed will have an important part to play in the station's labour relations policy, and experience and success in this part of the work is necessary; modern concept of management is essential.

Salary: Class L, Grade 6, i.e., £1,020 12s., including London allowance.

ASSISTANT SHIFT CHARGE ENGINEERS, WEST HAM GENERATING STATION. Candidates should have received a sound training in electrical and mechanical engineering and good technical training.

Candidates will be required to carry out the duties of control room engineers or boiler house engineers, according to requirements, and will be directly responsible to the Shift Charge Engineer.

Salary: Class G, Grade 9, i.e., £652 1s., inclusive of London allowance.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, London, S.W.1, and be received within fourteen days of the appearance of this advertisement.

H. V. PUGH, Divisional Controller. 5145

LONDON COUNTY COUNCIL

REQUIRED: INSPECTORS for electrical work with experience in erection and maintenance of electric passenger, goods and service lifts. Rate of pay 188s. a week.

Application forms obtainable by sending stamped addressed foolscap envelope to Chief Engineer, County Hall, Westminster Bridge, London, S.E.1 (quoting 51/54), returnable within next fourteen days. (1510) 5178

BRITISH ELECTRICITY AUTHORITY

North Western Division

APPLICATIONS are invited for the following superannuable positions:—

Vacancy No. 642. OPERATION ENGINEER, BURNLEY GENERATING STATION. The salary for the position will be £655/£680 per annum in accordance with Grade 5, Class C, of the N.J.B. Agreement.

Candidates should preferably possess technical qualifications, and previous experience in the operation of a generating station is essential.

Vacancy No. 643. INSTRUMENT ENGINEER, No. 3 SUB-DIVISION, located at Stuart Street Generating Station, Bradford, Manchester. The salary for the position will be within the range of £629/£834 per annum, in accordance with Grade 5, Classes AX/DX of Schedule C of the N.J.B. Agreement.

The successful applicant will be responsible for the organisation within the group of stations comprising No. 3 Sub-Division, for the efficient maintenance of all types of instruments associated with boilers and turbines other than purely electrical instruments. In particular, candidates must have had considerable experience in the operation and maintenance of automatic boiler control systems, and possession of a Higher National Certificate in Electrical or Mechanical Engineering, or an equivalent qualification, will be considered an advantage.

Applications, quoting vacancy number, stating age, qualifications, present position, and giving full details of education and experience, should be received by the Establishments Officer, British Electricity House, 825, Wilmslow Road, Manchester, 20, not later than the 5th January, 1952. 5144

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment from Engineers with practical workshop experience and ability in the handling of men:—

ASSISTANT MAINTENANCE ENGINEER (Mechanical), Rye House Generating Station, near Hoddesdon, Hertfordshire. This station will have an ultimate capacity of 180 MW (Class H).

Salary in accordance with the revised N.J.B. Schedule A, Class G, Grade 9 (£621-£648 per annum).

Experience in the maintenance of modern pulverised fuel boilers, coal and ash handling plants is essential. Some experience in the maintenance of turbine house and other generating station plant will be an advantage.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than 12th January, 1952. Envelopes should be endorsed "Assistant Maintenance Engineer (Mechanical), Rye House."

W. N. C. CLINCH,
Controller.
Northmet House,
Southgate, N.14. 5181

ADMIRALTY

VACANCIES exist for ELECTRICAL AND/OR MECHANICAL ENGINEERING DRAUGHTSMEN in Admiralty Research and Development Establishments located in the vicinity of Weymouth, Portsmouth, Teddington (Middlesex) and Baldock (Herts).

Draughtsmen experienced in light current, electro-mechanical, precision mechanical and electronic equipment are particularly needed.

Candidates must be British subjects of 21 years of age and upwards, who have had practical workshop experience (preferably an apprenticeship), together with drawing office experience. Appointments will be in an unestablished capacity, but opportunities will occur for qualified staff to compete for established posts.

The salaries offered, depending on age, experience, ability and place of duty, will be within the range £320-£575 p.a. Hostel accommodation is available at some establishments.

Applications, stating age and details of technical qualifications, apprenticeship (or equivalents), workshop and drawing office experience, should be sent to Admiralty (C.E.II, Room 93), Empire Hotel, Bath, quoting DM/R.D. Original testimonials should not be forwarded with application. Candidates required for interview will be advised within two weeks of receipt of application. 227

BRITISH ELECTRICITY AUTHORITY

Transformer and Protective Gear Engineers

APPLICATIONS are invited for the following appointments in the Transmission Design Branch at Headquarters in London:—

1. PLANT SPECIALIST (Power Transformers). Applicants should have extensive knowledge of the theory and practice of design and construction of power transformers and ancillary equipment, experience with 132-kV transformers and familiarity with 275-kV transformer design. Initiative, good personality and the ability to make clear and objective technical appreciations are essential. Salary within provisional range £750-£1,250.
2. SECOND ASSISTANT ENGINEER (Protective Gear). Applicants should have works and site experience in design and application of protective gear and in fault investigation. Salary, Grade 3, N.J.B., £814-£1,081 rising to £1,184.

Candidates must have engineering and educational qualifications not below A.M.I.E.E. standard. Pension scheme.

Forms from D. Moffat, Director of Establishments, British Electricity House, 170, Great Portland Street, London, W.1, to be returned by 10th January, 1952. Quote reference AE.224. 5209

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of ENGINEERING DRAUGHTSMAN in the Engineering Department at the Headquarters of the Board, Electricity House, Love Lane, Liverpool, 3, at a salary within the range £413-£547 per annum (N.J.B. D/6.

Applicants must have obtained the Ordinary National Certificate and have experience in the general design and layout of indoor and outdoor sub-stations up to 33 kV, cable layouts, diagrams of connections, etc.

The appointment is superannuable and subject to medical examination.

Applications should be made on forms obtainable from the Establishments Officer (ref. 20D) at the above address, and should be returned so as to be received before 7th January, 1952.

JAMES RANKIN,
Secretary. 5146

SOUTH EASTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT ENGINEER, Thanet District. Salary £694 to £708 p.a. under N.J.B. Schedule, Class D, Grade 5. Superannuation will be arranged. Applicants should be qualified, with a sound general and technical education, and be experienced in the design, construction and maintenance of H.V. and medium-pressure overhead and underground distribution systems; also in the operation of a large D.C. network, including the maintenance of rotary and rectifier sub-stations and in D.C./A.C. change-over. Duties involve standby. Person appointed will have the option of renting a seven-roomed flat.

Applications, giving two referees, must reach H. J. C. Carte, M.B.E., A.I.E.E., Thanet Manager, SEEBoard, St. Peter's, Broadstairs, Kent, by 7th January, 1952.

A. L. BURNELL, Secretary.
December, 1951. 5147

MID-WORCESTERSHIRE HOSPITAL MANAGEMENT COMMITTEE

ASSISTANT ENGINEER IN CHARGE required at All Saints' Hospital, Bromsgrove, Worcs. Preference will be given to applicants who have served an electrical apprenticeship. Salary commencing at £350 per annum, rising by annual increments of £15 to £425 per annum. The post is superannuable. A house is available for rental by the successful candidate.

Applications, giving the names of three referees, should be sent to the Secretary, Mid-Worcestershire Hospital Management Committee, Birmingham Road, Bromsgrove, not later than 18th January, 1952. 5196

SALARIED SALES ENGINEER

ELECTRICAL ENGINEER required to represent manufacturers of high-grade accessories in Lancashire and Yorkshire. Must be experienced in negotiating with senior officials. Apply by letter, stating qualifications, also level and form of remuneration sought, to—New Day Accessories Ltd., Mary Street, Birmingham, 12. 5089

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

Shift Charge Engineer

APPLICATIONS are invited for the position of SHIFT CHARGE ENGINEER at Dunfermline Power Station, Grade 7, Class C, of Schedule A of the N.J.B. Agreement, commencing salary £579 per annum.

Candidates should preferably have knowledge of steam electric power plant, including detailed working knowledge of operation of steam turbo-generators, modern boiler plant and high tension electrical switchgear. Certificated engineers with extensive marine experience would also be considered.

Applicants will be subject to superannuation under the terms and conditions approved by the British Electricity Authority.

Applications, stating age and experience, should be addressed to the undersigned not later than 12th January, 1952.

J. F. FIELD,
Divisional Controller.

British Electricity House,
High Street, Portobello,
Midlothian. 5203

A SENIOR executive appointment (design engineer) is offered by Bertram Thomas (Engineers) Ltd., Manchester, who are engaged primarily on the manufacture of heavy duty D.C. switchgear. The applicant should possess first-class scientific and commercial qualifications, sound practical experience, originality and initiative. He would have unlimited opportunity for developing his abilities at a salary rising without limit according to his performance. Write in first instance, giving fullest particulars, to—Box 62

A VERY wide selection of positions vacant, including production, design, research, maintenance in radio, radar, electronics, television, electrical, mechanical; also draughtsmen and tracers. Enquiries invited without obligation.—Technical Employment Agency, 179, Clapham Road, London, S.W.9. 5129

ADVERTISING department of well-known electrical engineering company in Central London requires an assistant (25-35). Duties include collecting and editing data from engineering and commercial departments for catalogues and technical publications. Some knowledge of electric lamps and lighting equipment is desirable. Write, giving details of experience and salary, to—Box 5096.

APPLICATIONS are invited for the appointment of general manager to established company engaged in the manufacture of electrical measuring instruments and electro-mechanical apparatus. Similar experience in management and commercial administration, and practical knowledge of factory organisation and routine essential. Write, giving full details of age, experience, etc., to—Box 5150.

APPLICATIONS are invited for the following positions in the London area: Planning engineers and tool designers; applicants must have experience on aero materials and modern machine shop practice. Also senior methods engineers, electrical and/or mechanical, with experience on development work in production shops. The positions are superannuated and offer considerable scope to men with adequate experience. Write, giving full details in strictest confidence, to—The Employment Officer, Rotax Ltd., Chandos Road, Willesden Junction, London, N.W.10. 5149

BRITISH ELECTRICITY AUTHORITY (North Western Division) requires deputy station superintendent at Trafford Generating Station, Trafford Park, Manchester, 17. Engineering qualifications and experience in administration, operation and maintenance of a steam generating station essential. Salary £887-£925 (N.J.B., Grade 3, Class F). Apply by 5th January to Establishments Officer, British Electricity House, Wilmslow Road, Manchester, 20, quoting Vacancy No. 644. 5200

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., 24, Fennel St., Manchester, 4. The company requires additional electrical plant inspectors. Permanent positions carrying progressive salary scale £520 to £750 and non-contributory pension. Candidates, age 26 to 30 years, with apprenticeship in the manufacture of electrical machinery and preferably with subsequent experience of repairs and industrial use of electrical machinery, and who have gained the Higher National Certificate in Electrical Engineering or are Grad. I.E.E., are invited to apply in own handwriting, stating age, qualifications and experience. 5182

CABLE jointers and overhead linesmen required by electrical contractors in the South-East and Eastern Counties. Men with experience of Air Ministry contracts preferred but not essential. Apply, giving full particulars of experience and qualifications, to—Box 5151.

CHARGEHANDS and electricians required by electrical contractors for Air Ministry contracts in the Eastern Counties. Men with experience of all types of installation work should apply, giving full details of past experience and qualifications, to—Box 5152. Applicants for the position of chargehand must have held a similar post previously.

DESIGNER. Wanted for Manchester district, experienced designer for A.C. and D.C. rotating machinery up to approximately 100 h.p. Good remuneration and prospects. Apply, stating qualifications and experience, to—Box B.8966, W. H. Smith & Son Ltd., Manchester 3. 5154

DRAUGHTSMAN required for North London, experienced in electrical and mechanical equipment. State age, experience and salary required, to—Box 5145.

DRAUGHTSMAN required with experience in electrical and mechanical drawing. Write—F. H. Pride Ltd., Electrical Fittings & Equipment Manufacturers, 81, Clapham High Street, London, S.W.4. 4994

DRAUGHTSMAN, senior position for experienced young man, in firm commencing design of new light to medium mechanical and electrical equipment. Workshop practical experience an asset. Barnet district. Write, stating age, experience and salary required, to—Box 5155.

DRAUGHTSMEN (one senior, one junior), electrical. Age range 24-48. Experienced L.T. control gear, plant layout and diagrams. Must have sound recognised apprenticeship and possess Higher National Certificate or equal. Site within easy reach of Wolverhampton. Good pension scheme (compulsory), canteen facilities, 5-day week. State age, present salary, give references and details apprenticeship training.—Box 4830.

ELECTRICAL engineer, junior, required for automatic electrical motor control gear manufacturers' technical sales department. Apply — Sales Director, Contractor Switchgear Ltd., Blakenhall, Wolverhampton. 4995

ELECTRICAL engineer required for large factory in West London area. Applicants must have sound technical background, preferably holding recognised qualifications, and have considerable experience in all maintenance work and the installation of H.T. and L.T. motors, starters and main switchgear for a wide variety of process plant requirements up to 1,000 h.p., including experience of steam turbo-alternator. The position is a highly paid one and qualifies for staff superannuation. Reply in confidence, stating age, experience, technical qualifications and positions held, to—Box 5169.

ELECTRICAL engineering tutors. Opportunity for 2 qualified men (1) with telecommunications experience, (2) with experience in generation and transmission. Pensionable appointments with eminent London correspondence college. No Sats. Canteen. Details of age, experience, salary required, to—Box 5166.

ELECTRICAL engineers are required by Joseph Lucas Ltd. for their design and development laboratory. Applicants should be at least of H.N.C. standard, with experience in the electrical design of small motors and generators. The work is varied and interesting, with excellent prospects for men with initiative and the required technical ability. Junior laboratory engineers of O.N.C. standard are also required for testing and investigational work on automobile electrical equipment. Please reply, stating qualifications, experience and age, to—Personnel Manager, Joseph Lucas Limited, Great King Street, Birmingham. 5156

ELECTRICAL exporters in London require invoice and correspondence clerk. Previous export experience unnecessary. Write, stating age, experience and salary required, to—Box 5168.

ELECTRICAL testers with experience of testing all types of A.C. and D.C. machines, including heavy plant. Control gear testers are also required. Applicants should possess technical knowledge at least equivalent to Ordinary National Certificate. Applicants should possess technical knowledge at least equivalent to Ordinary National Certificate. Applications, stating age, experience and details of technical training, to—Head of Personnel Dept., British Thomson-Houston Co. Ltd., Rugby. 5012

ENGINEERS and physicists are required by the Electrical Research Association for investigations on (i) novel sources of electrical energy (experience needed in instrumentation or automatic control), (ii) principles of the solid state as applied to dielectrics, (iii) gaseous ignition, (iv) high-frequency communications, (v) research on light-current and power components. Starting salaries will be in the range £500-£750 p.a., but in certain instances higher starting salaries will be considered, and there are also more junior positions with starting salaries in the range £400-£500 p.a. Subject to a probationary period, F.S.S.U. applies to members where eligible, or an equivalent scheme if not eligible under F.S.S.U. rules. Application should be made to—The Director, E.R.A. Laboratory, Wadsworth Rd., Perivale, Greenford, Middlesex. 5183

ELECTRICAL wholesalers require clerical assistant with good knowledge of installation material. Apply—London Electrical Co., 92, Blackfriars Road, London, S.E.1. 4996

INDEPENDENT lamp works require foremen for all departments, particularly for miniature lamps. Progressive position for energetic and ambitious applicant. House may be provided.—Box 7950.

JUNIOR contracts engineer required by manufacturers of diesel-electric locomotives. Applicants should be between the ages of 22 and 30, with technical training to Graduate I.E.E. or I.Mech.E. standard, and preferably practical experience or an apprenticeship with manufacturers of diesel-electric traction equipment. The post will involve the commercial and general technical aspects of diesel-electric locomotive manufacture and it will be an advantage if applicants possess previous contracts experience of this nature. Excellent prospects for man with personality and ambition. Applications in confidence to —Box 5109.

JUNIOR technical sales assistant required for quotation and order work in switchgear manufacturer's London office.—Box 7952.

KENYA. The East African Power & Lighting Company have a vacancy for a consumers' engineer for the Nairobi District. Applicants must have had previous experience of a similar commercial position in a large undertaking over several years. Preference will be given to Chartered Electrical Engineers. Commencing salary will be £1,000 per annum, plus a marriage allowance of £100 per annum, free house with free electricity, company medical scheme, six months' leave on full pay on completion of four years' tour, with free passage out and home for the successful applicant and his wife. Post, which is subject to a six months' probationary period, is pensionable and there is a dependants' benefit scheme. Applications, giving full particulars of past experience, technical qualifications, age, etc., should be addressed to —Balfour, Beatty & Co. Limited, 66, Queen Street, London, E.C.4. 5184

KUWAIT OIL Company invites applications for the post of assistant electrical engineer (installation) in Kuwait. Required for installation of high-voltage switchgear and plant up to 11,000 volts and motors up to 500 h.p., also the checking of complex protective relays. Mechanical experience an advantage. Must possess Higher National Certificate, but preference given to corporate members of I.E.E. Age 30 to 35. Salary starting £830 per annum, plus generous allowances, kit allowance and pension scheme. Write, giving personal details and quoting K.1386, to—Box D/60, at 191, Gresham House, London, E.C.2. 4833

KUWAIT OIL Company requires an assistant electrical engineer (design) for service in Kuwait. Must possess full electrical apprenticeship and Higher National Certificate. Graduate members of I.E.E. will be given preference. Must have experience in mains design and planning up to 11,000 volts. Planning of industrial layouts an advantage. Age 30-35. Salary starting £830 p.a. clear, plus generous allowances, pension scheme and kit allowance. Write, giving personal details and quoting K.1391, to—Box D/81, at 191, Gresham House, London, E.C.2. 4846

KUWAIT OIL Company requires electrical instrument engineer for overseas service in the Persian Gulf. Full apprenticeship with reputable instrument manufacturer essential and experience in manufacture and supervising of all types of electrical meters and instruments including protective relays, automatic voltage regulators, etc. Higher National Certificate essential. Age under 35. Salary starting £830 p.a. clear plus generous living allowance. Kit allowance; pension scheme. Write, giving details and quoting K.1159, to Box E/79, at 191, Gresham House, London, E.C.2. 5126

LADY technologist or graduate required for engineering test dept., S.E. London, to be responsible for technical records. Ability to undertake technical investigations under guidance; knowledge of typing an advantage but not essential. A lady engineering student is also required. Write, stating salary required, giving qualifications and previous experience, if any, to—Box E.A.651, at 191, Gresham House, London, E.C.2. 5014

LIGHTING representative required with sales ability and sufficient technical knowledge to enable him to stimulate interest in large fluorescent installations and discuss technical aspects with lighting consultants, architects, etc., London area. Write, giving full particulars in confidence, to—Box AC.68201, Samson Clarks, 57/61, Mortimer Street, London, W.1. 5193

MECHANICAL engineers. Large engineering firm in Manchester require mechanical engineers with university degree and conversant with servo-mechanisms. Apply in writing, stating age, qualifications, experience, etc., marking envelopes " Engineers," to—Box 5198.

PRODUCTION engineer required by factory in Hertford area. Must be used to small part assembly, preferably in the electrical trade, to take charge of a department engaged on this work. Apply, giving full details of previous experience, to—Box 5016.

PUBLICITY department of diesel generating plant manufacturers requires man with good electrical engineering background to prepare technical literature and advertising copy. Ability to draft clear and readable technical matter essential. Some publicity experience an advantage but not essential. Write, stating age, experience, salary required and when free, to—Petbow Ltd., Sandwich, Kent. 5083

QUALIFIED electrician with practical experience of maintenance on complex control gear and also electrical instruments, electronic gear, clocks and small equipment generally. Oldbury area. Write, giving full details of experience, etc.—Box 5185.

REPRESENTATIVE for established manufacturer to call on wholesalers, Northern Ireland and Eire. Give particulars past experience, age, salary required. Car an advantage.—Box 4977.

REPRESENTATIVE required by well-known manufacturer. Part London and Eastern Counties. To call on wholesalers and Electricity Boards. State age, experience, remuneration required.—Box 4976.

REQUIRED urgently, junior electronic engineer for development of radio interference suppressors and general test room duties. A.I.D. experience very desirable. Single man under 30 having H.N.C. preferred. Apply—Aish & Co. Ltd., Vanguard Works, Poole. 5157

SENIOR contracts engineers required for large installation contractors' office in Eastern Counties. Engineers with knowledge of Air Ministry contracts preferred but not essential. Only qualified engineers need apply. All applications will be treated in strict confidence.—Box 5153.

SENIOR design draughtsmen required. Applicants must be experienced in gear design, fabrications and electro-mechanical equipment. Good working conditions and prospects. Apply in writing, stating age, experience, salary required, etc., marking envelopes " G.S.," to—Personnel Manager, Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester, 17. 5199

SWITCHGEAR contracts engineer required in London area. Must be fully experienced in estimating and preparation of tenders for cubicle, flat back and industrial type switchgear. Write, stating salary, age, technical qualifications and experience.—Box 7954.

SWITCHGEAR design draughtsmen, or men with good general design experience. Interesting work on varied range of switchgear at attractive salary for men with good experience and/or qualifications. Send full particulars to —Personnel Manager, Cooke & Ferguson Ltd., Openshaw, Manchester, 11. 5106

SWITCHGEAR specialists require contracts draughtsmen having experience in the handling of H.V. indoor or outdoor contracts. Please reply, stating age, experience and salary required, to—The Personnel Manager, Cooke & Ferguson Limited, Openshaw, Manchester, 11. 5107

SWITCHGEAR specialists require contracts engineers for Manchester works to prepare engineering projects up to 132-kV H.V. systems in Canada, South Africa and Australia in addition to B.E.A. contracts. Attractive salary commensurate with experience. Reply in confidence, stating age, experience and salary, to—The Personnel Manager, Cooke & Ferguson Ltd., Openshaw, Manchester, 11. 5108

TECHNOLOGISTS, mechanical engineers, Higher National Certificate or graduates, 20-30 years, required for permanent appointments mechanical test dept., S.E. London. Must be capable of undertaking investigations into performance and analysing of test results of electro-mechanical, mechanical and hydraulic mechanisms. Some test gear design from specification data and routine testing involved. Write, stating salary required, giving qualifications and previous experience, to—Box E.R.652, at 191, Gresham House, London, E.C.2. 5015

THE WAR OFFICE have a vacancy in London for an assistant technical officer. Applicants should have served an apprenticeship in electrical engineering and hold a Higher National Certificate with electrical subjects, or preferably be Corporate Members of the I.E.E. Experience in technical administration and service with the Armed Forces would be an advantage. Duties are concerned with the organisation of maintenance and repair of Army electrical equipment other than telecommunication, e.g., generators, charging sets and batteries, etc. Salary scale is £675 to £825 p.a. and point of entry will be in accordance with age, qualifications and experience. The post is unestablished, but there are possibilities of establishment. Application forms obtainable from Technical and Scientific Register (K), Almack House, 26, King Street, London, S.W.1, quoting D.256/51-A. Closing date, 12th January, 1952. 5167

TRACTION motor draughtsmen and designer-draughtsmen required by manufacturers of diesel electric locomotives. A sound knowledge of the mechanical as well as the electrical design of traction motors is essential, and applicants should have a wide experience of modern design and production methods in this class of work. Good salaries will be paid to men having these qualifications, and special consideration will be given to other problems connected with the engagement of senior staff. Three-year agreement and every facility to find suitable living accommodation will be given. Please apply, giving full details of training, experience, age, etc., to—Box 5158.

TYPIST/bookkeeper required by electrical engineers in Harrow. 5-day week. Write, stating age, experience and salary required.—Box 5186.

WANTED, to act as representative for the sale of non-destructive testing equipment (X-ray, Gamma-ray, ultrasonic, magnetic), one young man (experience in industrial radiography essential). He is required for Scotland. Please reply to Box 5206, stating experience and salary required.

WE have the following vacancies: Fitters, turners and armature winders; and shall be pleased if applicants will contact CAN, 3227.—Collins Electrical, Upper St., London, N.1. 198

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

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BUSINESS executive, long experience accounts, contracts, purchasing in electrical engineering industry, considerable time present company, seeks position with better prospects.—Box 5179.

ELECTRICAL engineering executive, B.Sc., A.C.G.I., A.M.I.E.E. (38), 15 years' experience in design, development and production of light electro-mechanical control systems and equipment, seeks new executive post with prospects.—Box 7928.

EXPERIENCED electrician requires situation. Maintenance or contractors.—A. T., 57, Thornhill Rd., London, E.10. 7943

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STEAM-DRIVEN ALTERNATOR SETS, suitable 160 lb. pressure, 3-phase, 50 cycles, each complete with Exciter:—

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A.E.C. diesel alternator set, electric start, 60 kVA, A.C., 220/415 v., 3-phase, 50 cycles, 4-wire. Thoroughly overhauled and unused since. Apply—189, Wootton Rd., King's Lynn (Tel. 4127). 5081

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COVENTRY Climax 3-kW, 230-volt generating sets, reconditioned and fully guaranteed.—Magstarlite Ltd., Beavor Works, Beavor Lane, Hammersmith, London, W.6 (Phone, Riverside 4291). 5190

DIESEL generating sets, various sizes for sale.—Alliance Electrical, 2, Henrietta Street, London, W.C.2. 47

DIESEL electric plants, from 3-20-kVA output, with remote push-button control and automatic voltage control; prompt delivery; 3-kVA pattern with Petter engine, 275.—Ward, Lordscroft Works, Haverhill, Suffolk (Tel. 253). 1

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ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 13

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THE Fifty-second Annual General Meeting of The Sun Electrical Co. Ltd. was held on 14th December in London. The following is an extract of the directors' report and the statement by the Chairman, Mr. W. L. Rawlings, circulated with the accounts:—

Despite a further rise in overhead expenses the trading profit increased by nearly 50%. This was achieved by a substantially higher level of sales in all departments and branches, accompanied by greater operational efficiency throughout.

Net profit after taxation has increased by over 6% to £44,249, and your directors could have recommended a higher rate of dividend on the Ordinary Shares than that proposed. I must point out that an excessive rate of taxation, the continuing high level of sales and stocks, together with constantly increasing costs and the expenditure on new branches, are having their effect on the company's cash resources. We, in common with so many other companies, are reaching the time when it becomes difficult to finance the company's growing activities with our existing resources. It is for this reason that your directors have decided to recommend that the Ordinary Dividend shall be not more than 15%, which compares with the 10% paid last year.

The increase in the figure for freehold premises results from the purchase of new branch premises at Guildford. We have also acquired on reasonable leasehold terms some excellent factory type premises at Wembley. Our branches at Slough, Leeds and Newcastle-on-Tyne have again made a substantial contribution to the satisfactory results of the company.

Mr. A. G. Owen, who has been with the company for 45 years, has been appointed by the Board as "Director, Installation Accessories."

We have so far succeeded in obtaining a slightly higher level of sales than in the same period of 1950. Bearing in mind, however, that expenses are still rising and that sales may be adversely affected by the Government's policy of curtailed capital expenditure, it is difficult to foresee the final outcome of our efforts this year. Apart, however, from these contingencies, I am confident that our results this year will compare favourably with those now presented to you. 5165

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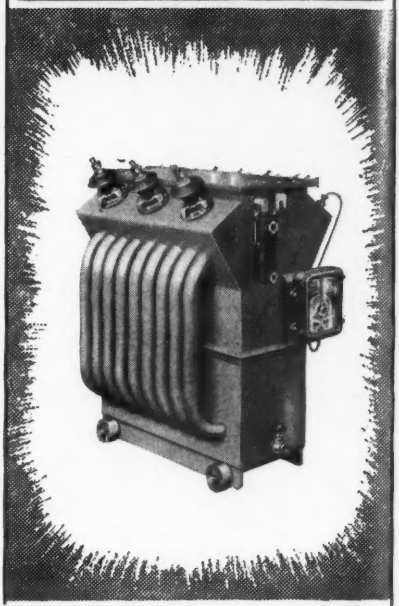

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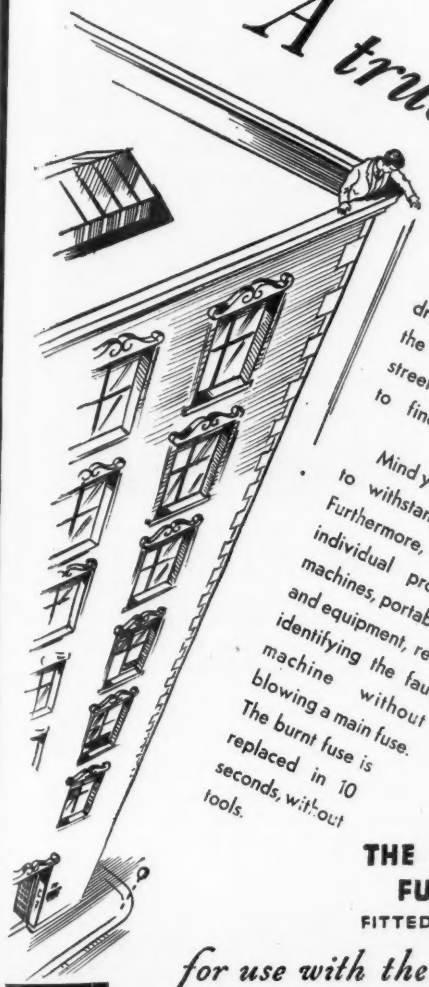

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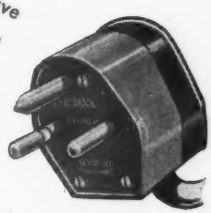

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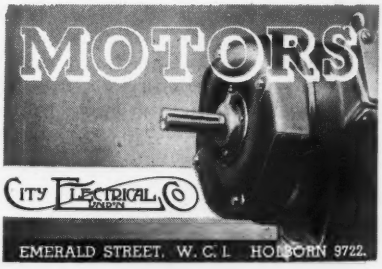

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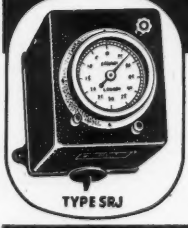

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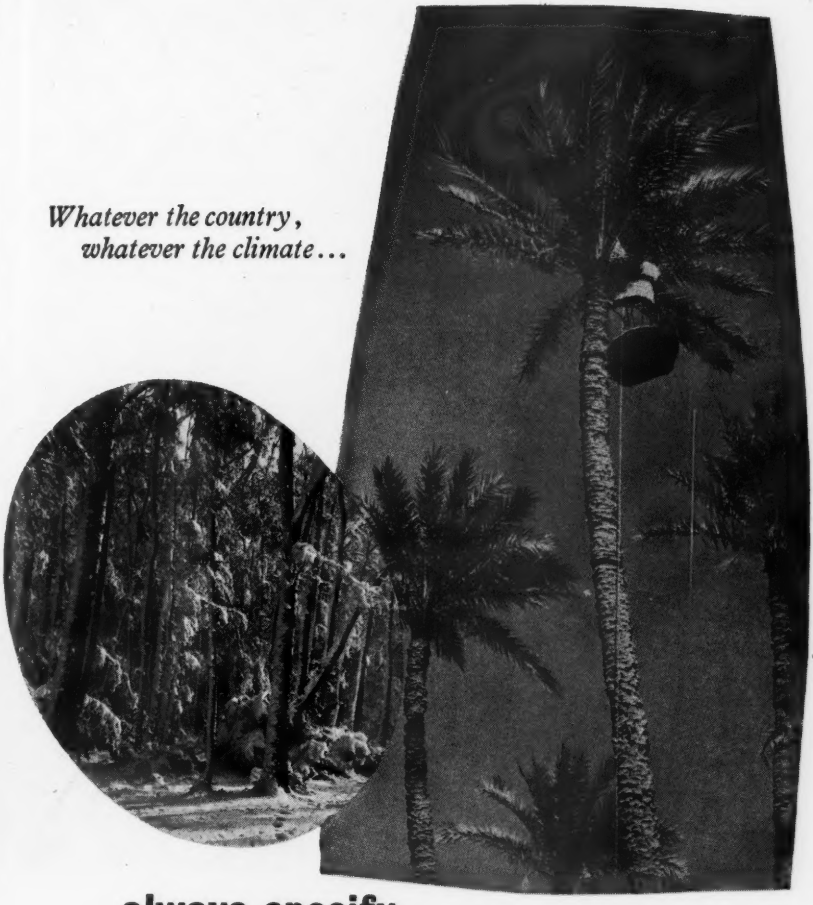

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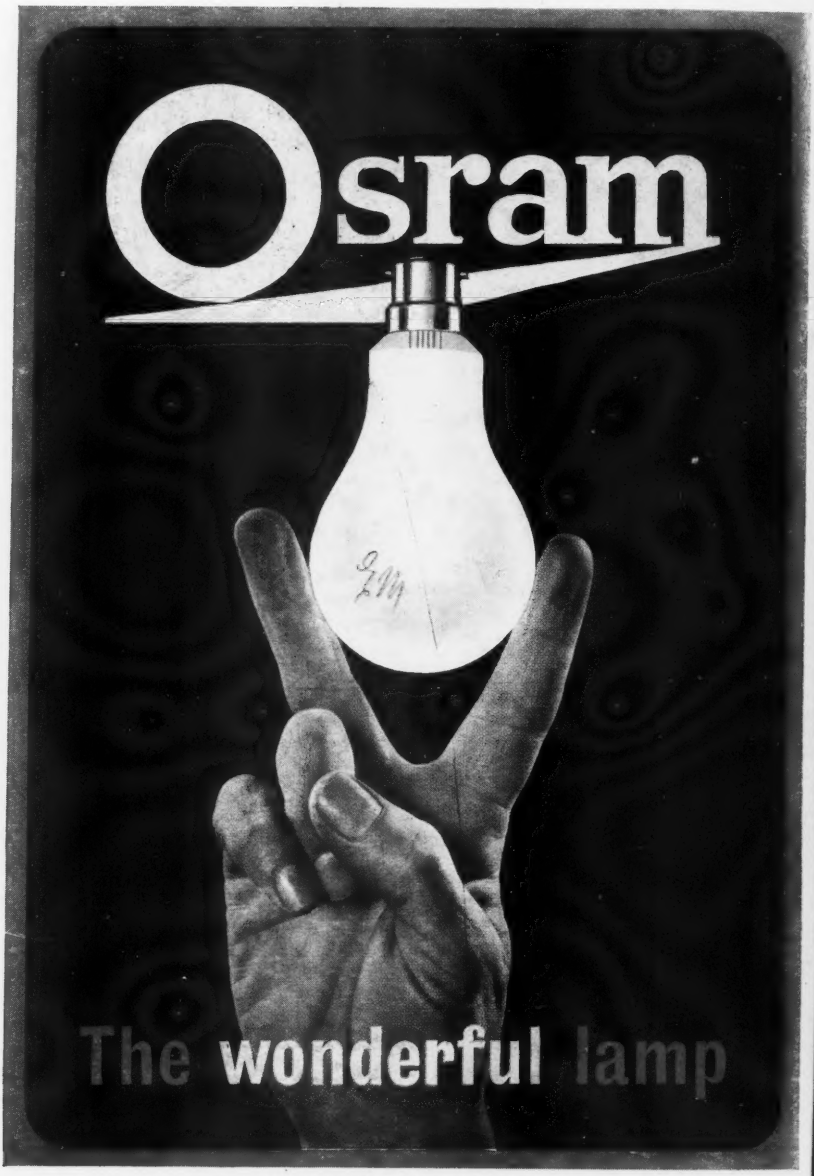
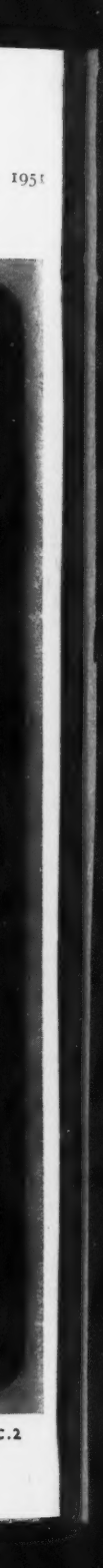
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